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RAMBLER, Jr.

TELEPHONE ENGINEER

MANAGEMENT · ENGINEERING · MAINTENANCE

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Telephone Engineer Publishing Company

A Magazine devoted to the interests of the entire telephone industry—operating men and manufacturers.

SERVING THE FIVE BILLION DOLLAR TELEPHONE INDUSTRY

Founded in 1909

Office of Publication, Pontiac, Illinois. Executive and Editorial Offices 185 N. Wabash, Chicago, Illinois. Phone Franklin 4094. J. A. SMITH, President and Treasurer; RAY W. SMITH Vice-President and Editor; L. M. BERRY, Vice-President; D. WEINER, Secretary Subscriptions: U. S., Cuba, Mexico, $1.00 Per Year; Canada, $1.50; In all Other Countries, $3.00. Single Copies, U. S. A., 15 cents.

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TELEPHONE ENGINEER
MANAGEMENT • ENGINEERING • MAINTENANCE

APRIL, 1939

"Tapping In"

ON WASHINGTON

AND THE

WAGE-HOUR SITUATION

WHETHER the telephone industry will obtain the enactment of legislation from the present Congress to provide relief from the Wage-Hour law's provisions for the small exchanges was the major question in Washington affairs that appeared likely to be answered during April.

A tangled situation prevailed in the National Capital on the legislation to amend that statute, the Fair Labor Standards Act of 1938, to grant the small exchanges of the telephone industry exemption from the minimum wage and maximum hours of work provisions in the case of their switchboard operators. The final result of Congressional action appeared likely to take one of several turns.

First, there was the Administration-sponsored omnibus amendments bill, covering several phases of the Wage-Hour Act, including the exemption of the operators of "public telephone exchanges" with less than 350 telephone stations. This bill met the approval of Wage-Hour Administrator Elmer F. Andrews and presumably was sanctioned by President Roosevelt. The measure was introduced jointly in the Senate and House by the chairmen of the respective Labor Committees, Senator Thomas of Utah and Representative Mary Norton of New Jersey.

An increased exemption from 350 to 500 stations to relieve telephone exchanges from the provisions of the Wage-Hour law was certain of approval by the House Labor Committee. The 500-station exemption was slated to be contained in the final Wage-Hour amendment bill which the committee is reporting to the house for passage. The increase in the exemption level represented a most important victory for the excellent work of the Wage-Hour committee of the United States Independent Telephone Association in presenting the full picture of the Independent industry to Congress and the government departments.

Editor's Note — This issue carries a very complete resume of this important situation. It is quite lengthy but every line should be read by all telephone men to its entirety.

The Editor

Second, the leading form organizatons, the National Grange, the American Farm Bureau Federation and others, opposed the Thomas and Norton bills in their amendments covering agricultural industries and workers and had induced Senator Miller of Arkansas and Representative Barden of North Carolina to sponsor measures containing their views. The Miller and Barden bills, however, did not cover the telephone exchange exemption proposals.

By ROLAND C. DAVIES
Editor
Telecommunications Reports

Third, on both sides of the Capitol were bills proposing exemption of telephone exchanges with 1,000 subscribers or less. These measures were sponsored by Senator Herring and Representative Harrington, both of Iowa. It appeared a possibility that their views would be given considerable weight by the Senate and House Labor Committee in the final formulation of the Wage-Hour amendment affecting the telephone industry.

BECAUSE of the confused status of the wage-Hour amendments, due to the unexpected opposition of the powerful farm organizations, the Senate and the House Labor Committees were expected to be unable to complete their final drafts of the measures for introduction on the floor until after the middle of April. Then it was deemed likely that the House would consume a week or so in debating the bill before any passage and the same amount of time or even more would occur during its consideration on the Senate side. After that the bills would go to conference —unless the procedure will be to have the House enact a measure and the Senate then take it up. But at best there seemed little chance of any final enactment by both branches of Congress for transmittal to the President prior to early May. The best speculation was that the Wage-Hour legislation might even drag on and not reach a final Congressional vote until late in May—and that was based on the premise that the present controversial elements in the Thomas and Norton bills would be ironed out in the early April

committee sessions so the measures would not meet opposition in the debate on the floor.

Increase in Level of Exemption for Telephone Exchanges Likely

The logical outlook at this writing (early April) was that the opposition of the farm organizations would be satisfied by the incorporation into the Thomas and Norton bills of their proposals. Then the bills would be approved by the Senate and House Labor committees.

Representative Harrington, Iowa Democrat, appeared before the House Labor Committee to advocate an increase to above 500 stations and Senator Herring, also an Iowa Democrat, was slated to emphasize similar veiws to the Senate Labor Committee. **At the same time, the National Association of Railroad and Utilities Commissioners, representing all the state commissions of the nation, supported the positon that adequate relief should be given the small telephone exchanges—more than thirty state commissions had voiced a strong view to Wage-Hour Administrator Andrews that exchanges with 1,000 subscribers or less should be granted exemption.**

New FCC Commissioner Appointed

THE Federal Communications Commission has a new member—Frederick I. Thompson, prominent Alabama newspaper publisher, who succeeds the veteran Commissioner Eugene O. Sykes. In the selection of Mr. Thompson, who publishes the Montgomery Journal and Times and who at one time edited two Mobile and one Birmingham newspapers President Roosevelt made a surprise "dark horse" choice, as the Alabaman's name had not been mentioned at all in the advance speculation.

Convention Schedule

Iowa Independent Telephone Association, Fort Des Moines Hotel, Des Moines, April 18, 19 and 20.

Ohio Independent Telephone Association, Deshler-Wallick Hotel, Columbus, April 25 and 26.

Indiana Telephone Association, Claypool Hotel, Indianapolis, May 10 and 11.

Conference of class A and B member companies, U. S. Independent Telephone Association, Chicago, Stevens Hotel, May 15 and 16.

Pennsylvania Independent Telephone Association, Yorktowne Hotel, York, May 18, 19 and 20.

New York State Telephone Association, Hotel Syracuse, Syracuse, May 23, 24, 25 and 26.

The Illinois Telephone Association, Pere-Marquette Hotel, Peoria, June 7 and 8.

Washington Independent Telephone Association, Mont Cristo Hotel, Everett, June 23 and 24.

Oregon Independent Tel. Assn., Portland Hotel, Portland, June 26.

Wisconsin State Telephone Association and Wisconsin Locally Owned Telephone Group, Park Hotel, Madison, June 13-15.

Besides his newspaper career, Mr. Thompson is chiefly known as a leading foe of the Alabama Power Company and his fight against that utility brought him in the Federal Trade Commission's power industry investigation in the late "twenties." Mr. Thompson has had an important tour of Federal Governmental service previously, when he served on the U. S. Shipping Board from 1920 to 1925 under three Presidents, Wilson, Harding and Coolidge. Although he has been a bitter opponent of the power industry, it is believed that Mr. Thompson has an "open mind" in regard to communications regulation and he is rated by his associates as an able intelligent official with high ideals of public service.

Rumors of other retirements from the FCC have bobbed up. Commissioner Thad H. Brown, Ohio Republican, who like Judge Sykes was a veteran of the old Radio Commission before being named to the FCC, is understood to be considering his retirement by the end of this year. If he does resign, Commissioner Brown is expected to remain until the end of 1939 so that he can complete the important survey of radio service for shipping on the Great Lakes and Inland Waters which he is directing. This survey is delving especially into the radiotelephone service for Great Lakes vessels in which the Lorain Telephone Co. of Ohio has pioneered.

The reappointment of Commissioner Paul A. Walker comes up next July 1, but there are understood to be some major obstacles in its path. Although he would undoubtedly have the backing of the two Oklahoma Senators, some Administration leaders are rumored to be cool on his reappointment and there would also be a very heated battle on his confirmation in the Senate because of the ex-parte procedure in the FCC Telephone Investigatiton. The retirement of Chairman Frank R. McNinch through his elevation to a judgeship or possibly a transfer back to the Power Commission also is a good likelihood at the close of this session of Congress.

THE FCC, incidentally, has now completed the final revision of the factual portion of the Walker Proposed Report on the Telephone Investigation and is to be engaged during the remainder of April and possibly during early May in the rewriting of the conclusions and recommendations of the Proposed Report. When it completes that task, the Final Telephone Investigation Report will be ready for transmission to Congress.

The most important recent action of the Commission was the approval of the construction of the 195-mile Coaxial Cable by the Bell System between Stevens Point, Wis., and Minneapolis, which will form a major link for increased long distance traffic on the Northern Transcontinental Route. The project which is to be installed by the American Telephone and Telegraph Co., Wisconsin Telephone Co., Northwestern Bell and Tri-State Telephone and Telegraph Co. will have an estimated cost of $1,969,000 and is designed to meet

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CHANGE OF ADDRESS

TELEPHONE ENGINEER PUBLISHING COMPANY

The publishers of TELEPHONE ENGINEER wish to announce the removal of their offices to

7720 SHERIDAN ROAD, CHICAGO

effective May 1, 1939, where we will occupy offices in our newly acquired building.

All mail addressed to this publication, pertaining to either business or circulation, should be forwarded to the new address, 7720 Sheridan Road, Chicago.

Construction of Telephone Manholes

By
RAY BLAIN

Setting the sectional steel form for a large manhole.

THE parade of passing years has caused a constant increase in the size of our underground telephone plant. Naturally, however, there remains in service large sections of aerial plant which will no doubt continue to prove its economic worth in sparsely settled regions for years to come. Then in the more thickly populated sections of the country there appears to be no doubt but that underground construction will continue to prove the most desirable. The first cost of underground ordinarily exceed considerably that of aerial plant. However, when the lower cost of maintenance over a period of years is considered, we believe the underground construction will invariably prove the most desirable investment.

When new underground plant is being considered the type of construction to use is often a hotly debated subject. There is a trend these days in some localities toward the use of steel tape armored cable buried without conduit. Also ordinary lead cable is often buried either with, or without, mechanical protection as local conditions in a certain exchange may dictate. The conventional type of lead cable with an outer rubber covering is now being developed which may serve a useful purpose in certain sections of the country when corrosion of cable is a proved detriment. Cable buried without conduit is, we believe, satisfactory and desirable in a few cases where the possibility of future growth is slight and ultimate requirements can be accurately forcast at the time of construction. However, buried cable does not ordinarily lend itself freely to increase in capacity, rearrangement or change. It is likewise true that the average modern telephone cable plant is in a constant process of expansion charge and rearrangement.

THE writer had the pleasure of visiting the new York World's fair during construction days and conversed with several telephone men who had to do with the installation of the large telephone plant of that mammoth, 20th century realization of a Barnums dream. During the conversation we remarked that no doubt the outside plant utilized buried cable. We were promptly advised that on the contrary it consisted entirely of cable in conduit and that standard manholes were used throughout. It was further explained that this type of plant was considered best suited to meet local conditions as the ultimate requirements could not be accurately forcast. Also reliability of telephone service was considered to be of upmost importance. It is the opinion that in case of cable failure or serious trouble, repairs can probably be effected more quickly with the duct system. In our honest opinion this same rule may be applied to the average large and medium sized exchange.

The various types of conduit are becoming fairly well standardized for telephone use. The types now in common use are; clay, single or multiple duct; fibre and creosoted wood. These conduits are ordinarily used in telephone plant without mechanical protection of any kind. Occasionally protection is used only under certain streets and in a few cases a concrete envelope is used throughout. Creosoted plank has also been used extensively in some localities for the protection of conduit. We are of the opinion that any of the modern conduit systems, if properly installed, will prove entirely satisfactory and economical in any telephone exchange.

● Maholes are without a doubt the most important part of the entire telephone underground system. They form

One type of service or pull box.

Below—Small sectional steel manhole in place with adjustable collar for opening. This is the old type form with a wood cover which has lately been replaced with a metal top.

Erecting a steel manhole form.

necessary junction points of the telephone system and should be of a suitable size for splicers to work in properly without crowding. Manholes should also be located at proper intervals to provide good distribution and flexibility in the cable system. In former days manholes were constructed exclusively of brick though at the present time concrete is used almost entirely in the telephone field.

The mistake should never be made of constructing small inferior manholes where larger ones are actually required. The initial saving will be small and unimportant and later rebuilding will probably be required. It is true that small service, or pull-boxes can frequently be used to advantage on small lateral cables where the probability of future growth is not apparent. However, these should not be confused with standard manholes. One type of pull-box with which we are familiar and used with complete success, measures 22" x 40" in size and is about 36" deep. The cover is oblong and the same size as the manhole. The cable is arranged for splicing a few inches above the ground level and then folds into the pull-box and in place on the racks.

Small size sectional manhole form in place ready for pouring of concrete.

OCCASIONALLY manholes 3' x 4' or 3' x 6' with 5' headroom are used but they cannot ordinarily be considered standard. Standard manhole sizes for telephone work, as recognized by the majority of the larger telephone companies at the present time may be considered as follows:

Type "A"
3' 6" wide, 8' long, with 5' 6" headroom.
Type "B"
3' 6" wide, 6' long, with 5' headroom.
Type "J-3"
3' 6" wide, 8' 6" long with 5' 6" headroom
Type "J-4"
4' wide, 8' 6" or 9' long and 5' 6" headroom.

These sizes will be found entirely adequate for all telephone work even when using the larger cables for they can be properly spliced and racked without difficulty. Money invested in manholes of this class will prove a worthwhile investment in any telephone exchange.

The construction of concrete manholes is a comparatively simple operation after the manhole form is once in place. The building of a wooden manhole form usually proves a difficult operation even for a good carpenter. Likewise it generally proves an expensive venture as the lumber will swell from the moisture in the concrete and must be practically destroyed in its removal. The little good lumber recovered will be coated with cement and practically worthless for any other purpose. Wood forms must be carefully braced to withstand the weight of the concrete. When a form lets go under the weight of the concrete the manhole, also time and money are a total loss. Likewise the reconstruction of such a manhole is always an extremely difficult task.

● The proper use of sectional steel manhole forms eliminate excessive cost and a great part of the work and worry from the construction of concrete manholes. The sections of these forms are sturdily built of 10 gauge steel plates reinforced by spot-welding to "L" angles. The sections are held firmly together with key boldts. These bolts are slotted and held in place with a tapering wedge driven in solid. Metal roof sections also set firmly in place and will not slip during the pouring of concrete. No special skill is required for the erection or dismantling of the forms. A common laborer can easily perform the task with the aid of an ordinary hammer which is the only tool required. Rustproof number plates assure quick identification of the various sections for assembly.

Angle iron braces, which are attached by the same key bolts which hold the sections together, easily carry the load of the concrete and distribute the strain evenly over the form. Friction plates consisting of strips of metal, are inserted between the sections of form vertically. After the manholes have been poured and permitted to set properly, the friction plates are first removed which reduces all tension on the sections and facilitates their easy removal. The parts after removal, all pass easily through the small roof opening.

ONE set of form sections can be used to construct any of the standard manholes mentioned above. The wall sections of the forms can be furnished in the expanding type if desired. These sections telescope and may be quickly expanded for different lengths to facilitate the construction of various sizes of manholes. This arrangement further reduces the cost of good manhole construction. Steel recess forms for duct entrances into the manholes are available for use to avoid the necessity of cutting out concrete around ducts after the manholes are poured. Special large loading coil type manholes can be constructed by the addition of extra sections of forms. Special sections may also be obtained for the construction of special octagon shaped manholes when desired.

To complete the sectional steel manhole form with its steel roof, the adjustable form for manhole cover openings should also be used. This collar is adjustable for the construction of openings required for 24, 27 and 30 inch manhole collar castings. This form provides a smooth finished tapering opening

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Short Course in Telephone Transmission

By B. C. BURDEN

(PART III)

Theory of Impedance Matching

For those that wish to obtain a good grasp of telephone transmission theory, it is essential that the subject of *Impedance Matching* be clearly understood.

This does not mean that all of the more or less complicated mathematical computations concerned with this subject be mastered but rather that one get the basic principle involved and be able to apply in practice correct impedance matching methods.

FIRST let us consider what is implied by the phrase *Impedance Matching.*

By definition the term *impedance* is the "total opposition offered to the flow of alternating current by a unit of electrical apparatus, or by a telephone, or power line." The term has about the same significance in an A.C. circuit as resistance has in a D. C. circuit. The various units of apparatus in the telephone field such as a telephone, a ringer, a receiver, etc., each has some fixed impedance (at a given frequency.) This is also true of telephone cable and open wire circuits. The magnitude of the impedance depends on the electrical makeup of the apparatus or circuit under consideration. (See Figure 1). A telephone ringer for example, (1000 ohm type) has an impedance of approximately 22,000 ohms, (1000 cycles) whereas a telephone receiver has an impedance of only 225 ohms, (1000 cycles). No. 19 gauge cable has an impedance of approximately 500 ohms, whereas the impedance of a No. 12 iron open wire circuit is 1590 ohms.

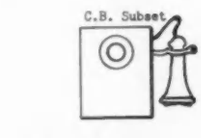


Fig. 1 — Impedances of typical Telephone Apparatus

Impedance Proportional to Frequency

It should be noted at this point the important fact that the impedance of any device or circuit *is proportional to the frequency* of the alternating current on which the device or circuit is used. Fig. 2 illustrates how the impedance of a ringer varies with frequency.

In the power field impedances are expressed in terms of 60 cycles. But in telephone work all impedances are usually expressed in terms of a 1000 cycle frequency as this represents the average value of the frequencies used in voice transmission. Hence when we say that the impedance of a telephone receiver is 225 ohms, we mean at 1000 cycles.

NOW why are we interested in the impedance of any device, and what connection has this with the subject of Impedance Matching?

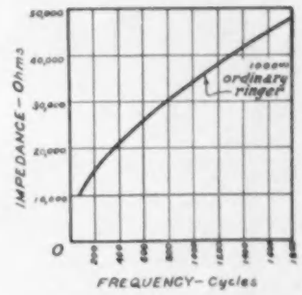


Fig. 2—Variation of Impedance with frequency.

Law of Maximum Power Transfer

One of the basic laws of electricity states that *"the maximum power will be delivered by any generator (known as the source) into any receiving device (known as the load), when the impedance of the generator and receiving device are equal.* (Note the law also states "and with equal and opposite phase angles." This latter fact can for practical reasons best be omitted from the discussion at this time).

In other words if we want to get maximum power from any generator as for example a telephone (may be considered as an A.C. generator) we must "match the impedance" of the telephone to the line or receiving device into which it works. The term "match" really means to "make equal to each other." This is shown in Fig. 3.

As will later be explained two unequal impedances representing a *source* of power, and a receiving device *or load,* can be "matched" by interposing between the two impedances a transformer, which will if it has the proper turns ratio, match the two impedances so that maximum power will pass from the *load* to the *source.*

Basic Reason that Impedances Must Be Matched

It can be shown by mathematical computations that the above statement is true, however, in order to keep our discussion simple let us merely look at a typical example which should satisfy us that the law just explained will be true in all cases.

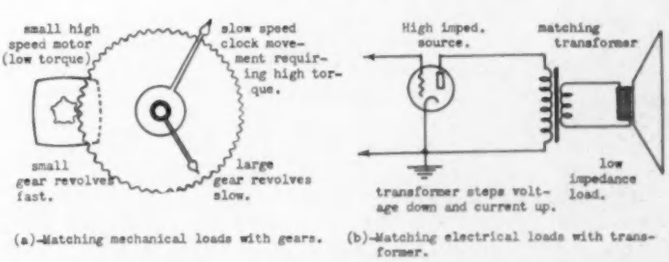
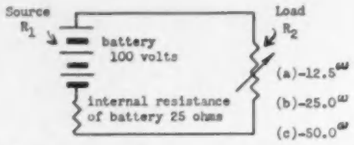

small high speed motor (low torque)
slow speed clock movement requiring high torque.
small gear revolves fast.
large gear revolves slow.
(a)-Matching mechanical loads with gears.
High imped. source.
matching transformer
low impedance load.
transformer steps voltage down and current up.
(b)-Matching electrical loads with transformer.

Fig. 3—Mechanical and Electrical Impedance Matching.



(a)-When load resistance is 12.5 ohms the ratio of R_2 to R_1 (load to source)is 0.5. The power delivered to the load is 88.8 watts.

(b)-When load resistance is 25.0 ohms the ratio of R_2 to R_1 (load to source) is 1.0. The power delivered to the load is 100.0 watts.

(c)-When load resistance is 50.0 ohms the ratio of R_2 to R_1 (load to source) is 2.0. The power delivered to the load is 88.8 watts.

Fig. 4—Power Loss Due to Mismatch.

REFERRING to Figure 4, which shows a D.C. generator (source) and a resistance (load), the power which the generator can deliver to the load is shown for three different values of load resistance. The figures show that 25% of the short circuit power will be delivered to the load when it equals the source resistance but only 22% will enter the load when the load resistor is one half as much as the source resistance and only 22% when it is twice as great as the source resistance. That is, the power we can get into the load resistor will be maximum at the point where the load resistance equals the source impedance but will fall off as the load resistance becomes either less or more than the source impedance.

Curve A of Figure 5 illustrates how the power in the external circuit becomes less either side of the point at which the two impedances are matched.

Curve B shows how the *power efficiency* varies for various load-source resistance ratios. It will be seen from this curve that under the ideal situation, i.e., when load and source resistances equal each other that 50% of the power generated will be dissipated in the source, and 50% in the load. When the load resistance is higher than the source resistance then less energy will be lost in the generator (source), hence the operating efficiency will be higher, but *in the communication field we are interested not in the operating efficiency but in getting maximum power into the load.*

Difference Between Power and Communication Requirements

So as to fix firmly in mind the subject of impedance matching let us compare the requirements in the communication field with those of the power field.

In the power field we are concerned with generating energy at the lowest possible cost. Our generators and lines are therefore designed and built to have a low resistance in order to minimize power (I^2R) losses. The greater these losses, the more power is required to turn the generators to supply power for the load requirements.

THE basic transmission design feature in the power field therefore involves the use of low loss connecting lines and the use of a fairly high voltage in order to keep the current small (for a given power) hence, the power loss is small. No attempt is made to "match" the load impedance to the source, for if this were done it would mean that one half of the energy generated would be dissipated in heat in the generator which would greatly increase the cost of power generation.

In the communication field, the power sources which are available are such devices as microphones, telephones, vacuum tubes, etc. and here we are not concerned with the cost of generating the power, as this is so small(except in the case of large transmitting type vacuum tubes) that it does not enter into the consideration. With the cost of energy out of the picture it is herefore natural that we would desire to get maximum power into the load as this enables us to talk further and use smaller and less expensive apparatus and circuits. Fig. 6 illustrates this difference in requirements.

The Author:
B. C. BURDEN
of the
Lincoln (Nebr.) Tel. & Tel. Company

With the reasons for matching impedances in the communication field explained, let us next consider how impedances can be matched, the effect of mismatching and other practical aspects of this interesting subject.

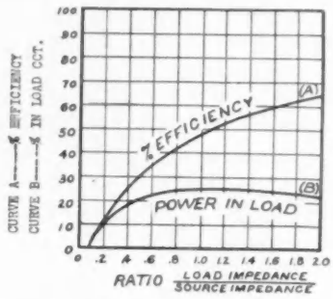


Fig. 5—Power Transfer and Efficiency Curves.

Impedance Relationship in Typical Telephone Systems

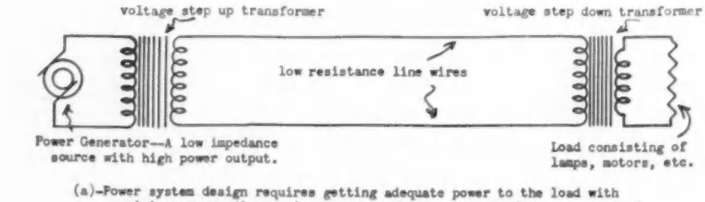
A telephone system offers a multitude of impedance problems though the operating telephone man is not ordinarily concerned, as the manufacturers of telephone apparatus designs their apparatus to work at best efficiency with the usual telephone circuits.

Telephones for example, have impedances ranging from 500 to 750 ohms depending on the type and make. The impedance of telephone circuits varies from 370 ohms for a No. 16 gauge cable pair up to 1590 ohms for iron wire. Though there is generally some mismatch in impedances between a telephone and the circuit to which it connects the magnitude of this mismatch is small and the transfer loss is not great hence for the practical operation of telephone circuits an exact match is not necessary. For example a mismatch of as much as 50% will result in a transfer power of only 12%. However for greater mismatches the power transfer loss increases rapidly.

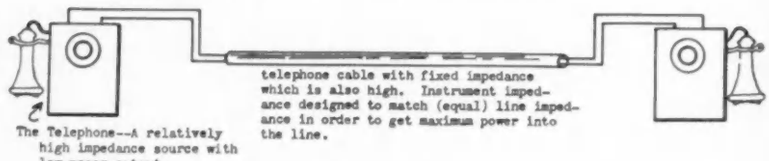
Use of Matching Transformers

In most small and medium size telephone exchanges no special equipment to match the impedances of line and subsets is required. In the larger metro-

(Please turn to page 28)


voltage step up transformer
voltage step down transformer
low resistance line wires
Power Generator--A low impedance source with high power output.
Load consisting of lamps, motors, etc.

(a)-Power system design requires getting adequate power to the load with minimum energy losses in generator, line, and transformers. Desired efficiency 100%.


telephone cable with fixed impedance which is also high. Instrument impedance designed to match (equal) line impedance in order to get maximum power into the line.
The Telephone--A relatively high impedance source with low power output.

(b)-Telephone System design requires that line and instrument impedance be matched in order that the maximum amount of power can be obtained from the subset. Desired efficiency resulting from this arrangement 50%.

Fig. 6—Difference Between Design of Power and Telephone Transmission System.

CABLE CORROSION

Compiled and Presented by E. S. TRUE

Present Day Problems Using Cathodic Protection

"Forced Drainage" if used in series with an existing "Cable System Drainage Wire", may be compared with the effects of "Rail Booster Returns' with or without the "Booster in Operation". The final adjustments of a "Telephone Cable Drainage Wire Current" system as given below, is a typical case where "Cathodic Protection" with properly designed "Booster Rectifiers" would be both economical and safe as a "Cable Protection" means.

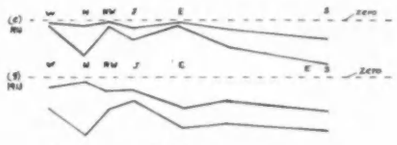


Figure 5—Cable-to-earth curves.

In the two sets of curves shown, these are both with TWO DRAINAGE WIRES. The first is with the City Railway Booster operating and the second is with the Booster not operating but with it's returns added to the track returns.

Condition (e) RAILWAY BOOSTER OPERATING. These curves show cable-to-earth from .05 to 1.6 negative with a slight reduction in the central part of the city which was directly effected by the negative booster returns. There was however a **slight increase** in negative values in the sections beyond the booster return area. The current in the drainage to city lines power house was about **20% less** than in 1912. The drainage current however to the interurban line station **increased about 25%** and the **reversal also increased,** which indicated a further depreciation of interurban line tracks. The cost of operation of the booster was found to be excessive and the beneficial effect was not sufficient to warrant the expense, and it was therefore discontinued.

Condition (g). BOOSTER CUT-OUT AND RETURNS ADDED TO TRACK RETURNS. These curves show cable-to-earth from .15 to 1.9 volts negative which was an increase over that in 1912. The current in the drainage to city lines power house **increased to 2½ times** that of 1912 although the current to the interurban line station remained practically the same. This would indicate that rearrangement of the city railway returns benefitted the telephone underground cable and eliminated the tendency for positive conditions in certain sections. The high negative-to-earth cable readings were later reduced by inserting balancing resistances in the drainage wires.

SPECIAL CONDITION. This covered a short period in September 1913 when work was done by an outside party which consisted in **insulating the interurban tracks from the city tracks,** while the city lines drainage system was not in operation. This resulted in a **75% increase** in the telephone cable drainage to the interurban sub-station and a **30% increase** in the drainage current to the city lines power house. This clearly showed the benefits obtained by keeping all tracks bonded together. After this work was restored, a .6 ohm resistance was installed in the telephone drainage to the city power house which reduced the current flow to approximately 50% of the former value.
1914.

The five sets of curves shown are the results of simaltaneous readings made with Bristol Recording meters after all of the joint work of electrolysis mitigation was completed by the Bureau of Standards. All of the previously tried arrangements of telephone cable protection were re-checked to determine the one best suited for permanent protection. The data consisted generally of one-hour charts although some of the more important readings were for 24 hours. The results show readings with NO DRAINAGE and with FOUR DIFFERENT DRAINAGE arrangements.

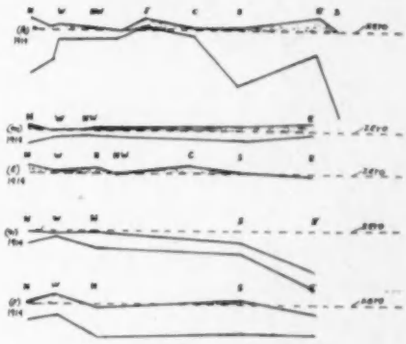


Figure 6—Cable-to-earth curves.

Condition (k) NO DRAINAGE. These curves show from .5 positive to 1.5 negative volts with minimum values POSITIVE at practically all points and a considerable increase in both positive and negative maximum values. This increase might have been partly due to some telephone underground extensions, although it was clearly evident that maximum conditions of underground structures to earth had changed considerably. The highest positive and negative readings are nearest the city railway power house which is the lowest potential of the track return system as re-arranged. Formerly the

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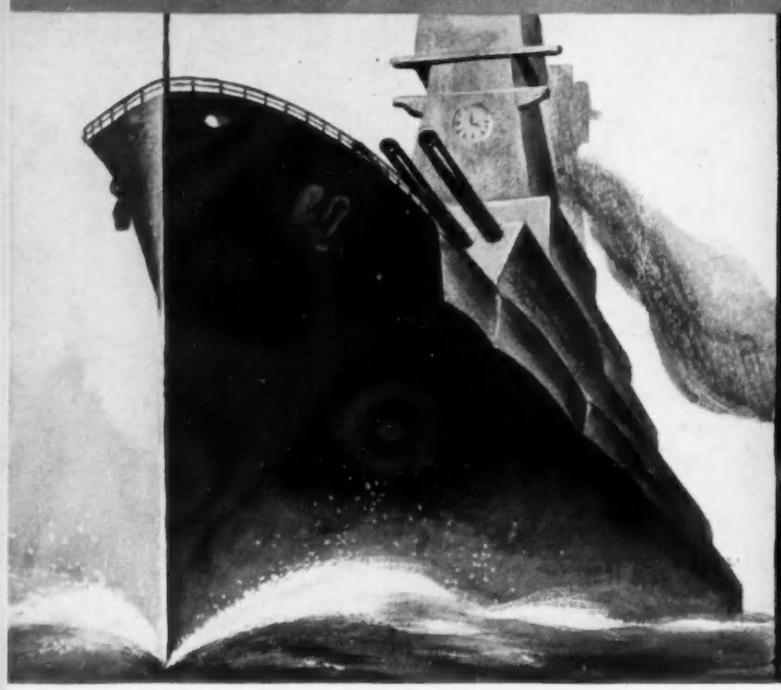

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In civilian activities, the adoption of this equipment is no less widespread

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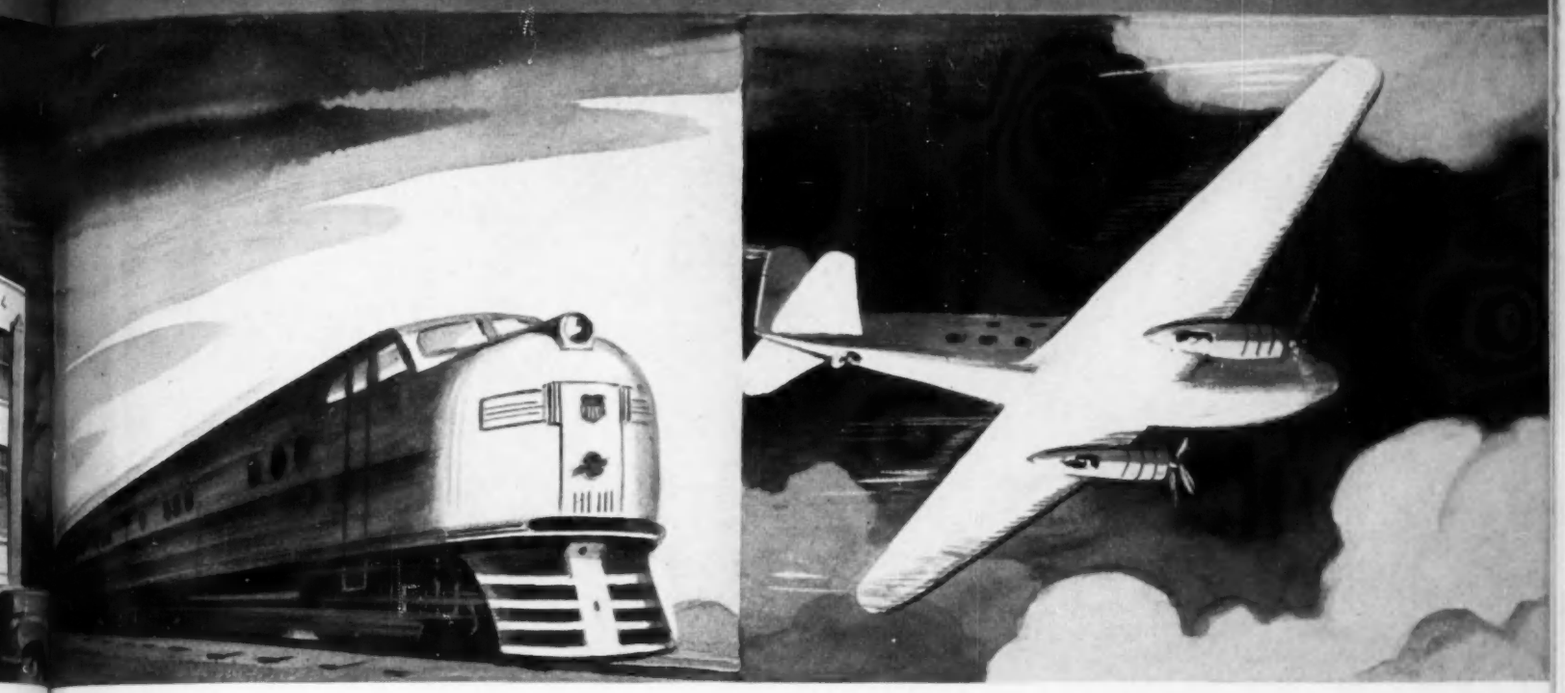

ec Name Represents
elble Communication

and the uses to which it is put no less exacting. In public telephone exchanges, in private industrial systems, on fast streamlined trains and on luxury liners of trans-continental airways, Automatic Electric products contribute their part to greater efficiency, safety and convenience.

No matter where you look in the modern scene, you will find Automatic Electric apparatus bringing economy of operation and reliability of performance to the communication services—positive and valuable attributes which distinguish the operation of this equipment in whatever part of the world it may be found.

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1033 W. Street, Chicago, U. S. A.

Export Distributors: AUTOMATIC ELECTRIC SALES COMPANY, LIMITED

(UPPER LEFT) Presiding at registration desk are Mrs. Jeanette Hensley (with newspaper) and Mrs. Maude Grider who is just bevond John Collier. "Voice with a Smile" contest cup in background.

(LEFT) General session Texas Telephone Association convention. Vice-president, Sam Shutt provides the rear expanse in the foreground.

(ABOVE) Don Hunnsaker, G. B. Foscue, Louis Pitcher and Howard Leinard are samples of photographic subjects selected by Cameraman M. S. Burton.

OSCAR BURTON, Tyler.
Re-elected to again lead Texas Independents.

Texans Discuss Vital Subjects

With the selection of C. H. Jennings, Alpine; Lou Rust, Del Rio; John Roper, Rosebud, and S. W. Teas of Floresville as new directors to bring the directorate from 17 to 21; plus re-election of present officers headed by Oscar Burton, Tyler, as president, The Texas Telephone Association adjourned one of the most interesting programs of its history with a golf tournament on the afternoon of the third day. It was held in Dallas, March 22, 23, and 24.

The most important subject, The Wage-Hour situation, received the undivided attention of the assembled convention because of its far reaching effects on the smaller telephone companies, of which Texas has several hundred. They enjoyed the privelege of hearing Louis Pitcher, executive vice president of the United States Independent Telephone Association discuss this all important law and the detrimental effect it will have unless the present interpretation is wrong or amendment exempting the smaller exchages of 1000 stations or less is passed during the present Congress. This subject was also discussed by Oscar Burton in the president's address during opening day.

Mr. Pitcher was "pinch-hitter" for Sam Shutt, vice president, who was delayed in reaching the floor by the untimely death of one of his company's old and trusted employees, during the afternoon of the opening day and again addressed the open meeting the following morning.

Secretary George Butler and his committee are to be congratulated on the very well rounded program and for his annual report which included a dissertation on the tax situation and other pending bills in the Texas legislature. Association officers have probably been busier during the past year than ever before in history, Jean Shotwell, Lufkin, treasurer of the association and R. B. (Doc) Fairly, Lubbock, 2nd vice president were much in evidence serving as hosts to those in attendance.

One of the most interesting addresses was made by J. F. Leopold, Supervisor of Public Utilities of Dallas on the subject "What the Public Thinks of Your Business." George Butler thinks it one of the best he has ever heard on the subject. His remarks on the public relations job now before the telephone industry in explaining various charges covering installation, etc. is a serious one and must be remedied before the industry can rest easy and know it will receive full consideration when the public threatens to condemn certain practices of any of the utilities.

SECRETARY GEO. BUTLER

Through the kind invitation of president Oscar Burton, the editor of TELEPHONE ENGINEER, a former Texan, attended the two meetings of the Board of Directors and was an interested listener to the discussions and the intelligent consideration of all subjects brought before it. The democratic atmosphere allowed frank discussions that brought results and accomplishment instead of delavs so common to association conventions. An undercurrent of satisfaction was noticed during the two meetings excepting the Wage-Hour and R.E.A. situations.

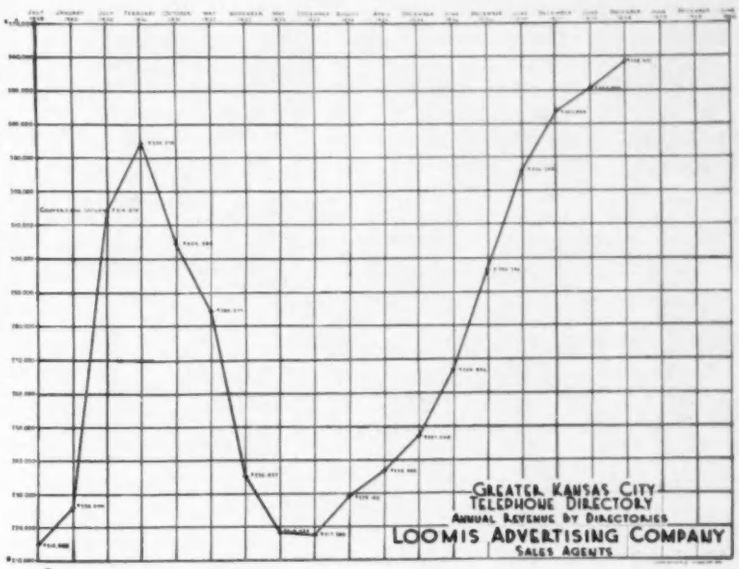
During the banquet that old timers stated was the best ever, the "Voice With A Smile Contest" was held and won by an operator from the San Angelo Telephone Company. Following was dancing and good fellowship that lasted till midnight.

Too much cannot be said to the benefit of the exhibitors that made this and all other state conventions the success they are. Their presentations this year were well attended and helped immeasureably in making the meeting a valuable and pleasurable visit.

Strong resolutions were read and adopted covering recommendations to members of Congress regarding the Wage-Hour law as it now stands in-

(Please turn to page 29)

Notes from a paper of W. H. Loomis, Jr., President of Loomis Advertising Company, Kansas City, Missouri, before recent Sales Conference and excerpts from an article written by Eldridge King, vice-president of the same company.



ADDED DIRECTORY REVENUES

A DECADE or so ago in giving consideration to various advertising media, the telephone directory would have been considered by but a few lines of business to say the most; however, with the development of telephone communication, the telephone directory has become more and more necessary as a reference medium and its value therefore as an advertising medium has been given increased recognition from year to year.

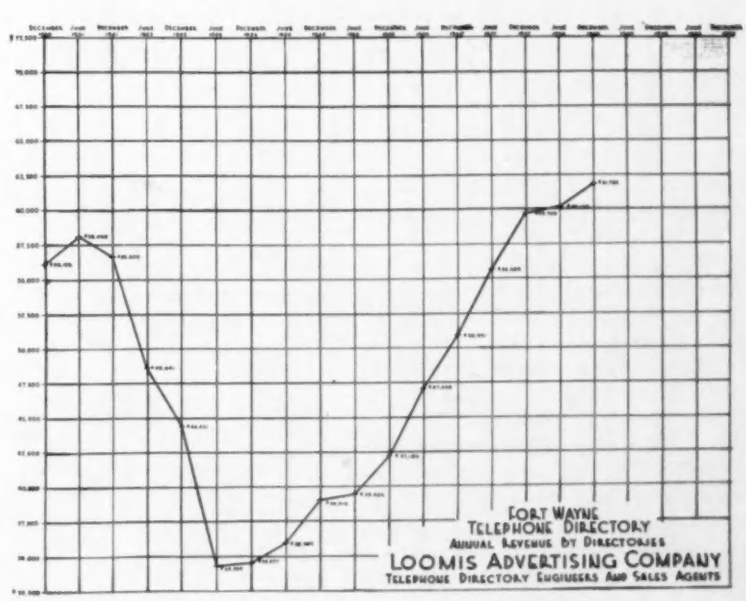
Manufacturers of products distributed regionally and nationally recognize its value as do most of the leading advertising agencies. Dr. Hugh E. Agnew, Professor of Marketing and head of the department of Marketing, New York University and Warren B. Dygert, Assistant Professor of Marketing of that same university in their book, "Advertising Media" published in the latter part of 1938 by McGraw-Hill have devoted nine pages to the telephone directory, recognition that cannot be ignored by either the public or the telephone companies themselves. In the words of these gentlemen, "its usefulness as a link between creative advertising and the point of sale cannot be minimized."

Telephone directory advertising is essential to any merchandiser who wishes complete coverage especially for those who appreciate point of contact advertising. It serves at the time the subscriber is looking for the telephone number with the same efficiency that well-planned counter cards or attractive labels do when prospective purchaser is in the store.

MANY telephone men rightfully thinking primarily of telephone service either overlook the value of the telephone directory as an advertising medium or are too busy with matters pertaining to telephone service to give the directory the attention it warrants. Right here is where the value of the sales agency comes in. It specializes in selling and more particularly in selling telephone directory advertising. Selling telephone directory advertising is not its least important task nor its most important, but its only task. Its men are trained in selling that particular service, and its ideas are a composite of selling ideas in all fields adapted to the sale of telephone directory advertising.

The sales agency can, through consistent, intelligent selling of the value of the telephone directory as an advertising medium to the telephone company's business subscribers, not only produce for the telephone company some very welcome revenue, but it can do the whole community a real service by making of the directory a book of valuable buying information and at the same time build good will.

BECAUSE of lack of foresight on the part of a few engaged in selling agency work when directory advertising was in its infancy, some telephone



men erroneously think of all selling agencies as high pressure organizations. The fact is the right kind of a selling agency realizes very definitely that the good will of telephone subscribers is of as much importance to the agency, if not more, as to the telephone company itself. Its salesmen must and do see the matter in this same light. Its operations will reflect that fact.

THE agency and its salesmen alike are not only interested in selling advertising but in the resale. The commission salesman must be able to resell if he is to continue to live, and so his sales must be clean and stand up under fire better than those of the salaried salesman, who gets his salary whether resales are made or not.

The telephone directory advertising sales agency operates the same as the telephone company's own department. Comparative figures show that in most instances telephone companies derive more net revenue from directories solicited by a sales agency. Due to its specialized selling the agency secures more collectible revenue. Hidden expenses such as payments to the state and federal governments for old age benefits and unemployment insurance are paid by the sales agency.

In our own experience as a selling agency of telephone directory advertising, we know how we have striven at all times (1) to improve our methods to keep pace with times and changing conditions, (2) to sell the directory as an advertising medium, (3) to offer intelligent, well-planned programs of directory service to subscribers so that the directories we sell would provide information wanted by the calling public, and (4) above all to build for the future by building good will. Working along these lines we have developed directories in both Associated Bell and connecting companies alike to the end that practically all the directories we sell carry more and better information today than at any previous time, more advertisers, more advertisers per one hundred business accounts, more items, and more annual revenue per business account. Many of the directories carry more total annual revenue than at any previous time.

BOTH Kansas City, as an Associated Bell company directory, and Fort Wayne, Indiana, as a connecting company directory, have shown successive all time highs in revenue for the last three issues. Charts showing these accomplishments are on display. The most gratifying part of the whole picture is that with all of these attainments the total adjustments made in the last issues of several of the most outstanding of these directories amounted to only 18/100 of 1%. **(END)**

Late in March this New York World's Fair picture of the uncompleted exhibit — The American Tel. & Tel. Company building — was snapped just after the snow had melted to allow workmen to complete in time for opening late this month. All Independents are invited to this exhibit.

Short Course in Telephone Transmission

(Continued from page 22)

politan areas, however, special means for matching the subscribers loop to certain types of loaded trunk cables are often required. The impedance of a loaded cable circuit is considerably higher than that of a non-loaded subscribers cable loop, hence in impedance matching transformer placed at the junction of the loaded and non-loaded cables results in a more efficinet transfer of energy.

The so called "impedance matching transformer" is nothing more or less than a voice frequency transformer (called a repeating coil in the telephone field).

A TRANSFORMER is usually thought of as a device which can "step" an A.C. voltage either up or down in magnitude. A transformer does do this but in effect it at the same time "transforms the impedances" connected to its terminals. When we "step up" the voltage of a low impedance source we are also "stepping up" the impedance itself.

The ratio of the voltages on the primary and secondary of a transformer are directly proportional to the number of turns in the two windings, that is, if the secondary has 10 times as many turns as the primary then the voltage will be stepped up to 10 times its input value in passing from primary to secondary winding. This is written in simple equation form as follows:

$$\frac{Vp}{Vs} = \frac{Np}{Ns}$$

Where:
V—voltage in primary and secondary
N—turns in primary and secondary

It can also be shown mathematically that the impedance which appears across either winding is equal to the **square of the ratio of the number of turns in each winding.** That is:

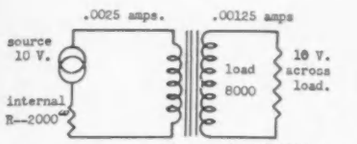
$$\frac{Zp}{Zs} = \left(\frac{Np}{Ns}\right)^2$$

Where:
Z—impedance presented across primary or secondary windings.

For those considering the impedance relationship in a transformer for the first time, there is often a tendency to become confused by the symbols Zp and Zs. Fix firmly in mind the fact that these symbols refer to the impedance one "sees" at either the primary or secondary terminals, and not the self impedance of the winding itself.

TO illustrate this important point let us take a practical example. Assume we have a transformer having 10,000 turns of wire on the primary winding and 20,000 turns on the secondary winding. According to the equation just given the impedance ratio would be:

$$\left(\frac{Np}{Ns}\right)^2 = \frac{Zp}{Zs} = \left(\frac{10{,}000}{20{,}000}\right)^2 = \frac{1}{4}$$



The transformer makes the 8000 ohm load "look like" 2000 ohms to the source, thus matching the load to the source impedance.

$$\frac{Z_p}{Z_s} = \left(\frac{N_p}{N_s}\right)^2 = \left(\frac{1}{2}\right)^2 \quad \frac{1}{4}$$

Fig. 7—Relationship in a Typical Matching Transformer Problem.

That is, any impedance connected to the primary winding would be transformed to an impedance four times as high on the secondary winding.

Therefore, if we would connect a 2000 ohm impedance to the primary winding, this impedance would "look like" an 8000 ohm impedance on the secondary winding. The voltage will be stepped up only two times in passing from primary to secondary, and the current in the secondary will be only one half as great as in the primary. These several relationships are illustrated by Figure 7, which shows a 2000 ohm oscillator whose open circuit potential is 10 volts. If this illustration is carefully studied the effect of a transformer on voltage, current, and impedance should be clearly understood.

(TO BE CONTINUED)

Seen for Future

(We are indebted to a reader who forwards us the following clipped from the Denver Post.)

Pasadena, Calif.—A vest-pocket telephone which a person can carry and operate without the use of wires is one of the possibilities of the near future, according to Dean T. Smith, engineer of the Southern California Telephone company.

Dean Smith has just revealed that the research department of his company has been working on this project for several years past and that they have now reached a point of development at which predictions can be safely made.

"Experiments made so far," said Smith, "reveal that a coil of wire so tiny that the strands can hardly be seen by the human eye develops a sufficient amount of magnetic electricity to carry the sound of voice a considerable distance without the use of ordinary wires.

"Since 1927, when the first telephone call was made to London, all limitations on telephoning in the world have been lifted."

71 Years Ago —

SEVENTY-ONE YEARS AGO in an eastern paper, the following news item appeared:

"A man about forty-six years of age, giving the name of Joshua Coppersmith, has been arrested in New York for attempting to extort funds from ignorant and superstitious people by exhibiting a device which he says will convey the human voice any distance over metallic wires so that it will be heard by the listener at the other end.

"He calls the instrument a 'telephone,' which is obviously intended to imitate the word 'telegraph' and win the confidence of those who know of the success of the latter instrument without understanding the principles on which it is based. Well-informed people know that it is impossible to transmit the human voice over wires, as may be done with dots and dashes and signals of the Morse Code, and that, were it possible to do so, the thing would be of no practical use or value.

"The authorities who apprehended this criminal are to be congratulated, and it is to be hoped that his punishment will be prompt and fitting, that it may serve as an example to other conscienceless schemers who enrich themselves at the expense of their fellow creatures."

Texans Discuss Vital Subjects

(Continued from page 26)

terpreted, and the Association stand that exchanges of 1000 or less stations should be exempt if service is to be continued on its present high scale.

The golf tournament was a handicap affair and low gross was won by Frank Eldridge, one of the popular manufacturers agents, with high going to a former editor of TELEPHONE ENGINEER, R. C. Reno, who is now vice president of the Telephone Management Company, Ft. Wayne, Ind. The dinner, following the golf tournament which was handled by Sam Shutt, was enjoyed by everyone.

Convention Observations On-the-Cuff:

Shaking hands with Al Robb and his rapid-fire son Dink, of Electra, and later receiving a letter, Pony Express to San Francisco and then by train to Chicago . . . Hello there John Burke, of National Carbon, thanks for the apple . . . Jimmy Stuart of Texarkana has a grand smile, even when he is busy . . . And there is one of Dad's old friends, Ira Fullerton, kidding me about cold weather . . . Jean Shotwell takes his conventions seriously and makes it pay . . . D. T. Strickland gets an orchid for his prophesies during a Directors meeting, and he is doing quite well, thank you . . . Meeting Fred Trower of Corsicana was a pleasure . . . Louis Pitcher and Garland Foscue brought their wives —and smiles, they must be having fun with their work . . . Al Jennings of Alpine can slap a golf ball silly and does—I know because I paid him . . . Glad to see you Mr. Winchester, of National Telephone Supply, altho we do miss Chas. Mahan . . . Those four gentlemen of Bell fame: W. L. Prehn, Howard Leinard, Chas. Vedder and Don Hunsaker are old friends we are again glad to see . . . Doc Fairly promising your editor a bunch of subscriptions . . . thanks for the compliments too . . . We missed T. P. Bearden . . . but did not miss blisters on hands and feet from the golf game . . . See you next year!

International Municipal Signal Assn. Meets

The 44th annual meeting of the International Municipal Signal Association will be held at the Providence-Biltmore Hotel, Providence, R. I., Oct. 9, 10, 11 and 12. L. Talley Garren, Columbia, S. C., is president.

Beats the Smiths, Joneses and Browns

Beating out such powerful competition as the Smiths, Joneses and Browns, J. L. Giuly has won the title of having his name listed in the Southwestern Bell Telephone Company directory more different times than any other one Dallasite.

He is listed five different times in the book with a different telephone number for each address. His friends can call him at 4342 Congress, 5733 Vickery, 5505 Columbus, 415 East Twelfth and 1629 Peabody.

"I don't have much trouble over the listings," he said. "My home is at 4342 Congress and the rest of the addresses are apartment houses under my management. They just give them my office or telephone number there.

LINE and DESK

RAY BLAIN, Member A. I. E. E., Editor

Q. Has there to your knowledge been any development attempted in the production of a load speaking telephone so that a conversation may be heard and replied to from any part of a room? We formerly used head phones on radio but the loud speaker has done away with all that so why should it not likewise replace the handset of the telephone?

A. We have every reason to believe that this could be accomplished with equipment now available if it was commercially desirable. In fact the loud speaking telephone is now used successfully on some intercommunication telephone and paging systems. We doubt though that such an arrangement would prove desirable on regular telephone service, especially when several telephones are installed in a large office. The present handset telephone with its comparative privacy of use we believe is highly desirable.

Q. When installing fibre conduit to be incased in concrete is it necessary to provide spacers and forms to retain the concrete?

A. While this method is frequently used it is not considered a necessity. Conduit may be installed by the tier method as follows: a foundation of concrete is first placed in the bottom of the trench and tamped to an even surface. The bottom tier of ducts is then placed on this foundation. The ducts are then covered with concrete to a thickness to provide proper separation if a second tier of ducts are to be installed. With this method the trench acts as the form and should be dug accurately to avoid waste of concrete.

Q. We have noted an aerial cable hanger, ordinarily used at poles, which consists of a metal strap which wraps around the cable and attaches to the messenger by a hook. Can you tell us why these are used?

A. We are of the opinion that you refer to the so called, aerial cable clips which consists of a strip of zinc which is wrapped around the cable and a supporting hook which attaches to the messenger loosely. These clips are usually placed two on each side of a pole to reduce the possibility of ring cuts. The twist in an aerial cable caused by the sway of a messenger strand occurs near the suspension clamp on a pole and this clip is supposed to absorb the twist and protect the cable.

Q. Can you tell us how the sharp pike poles can be protected when not in use or when carried on a truck?

A. A recently developed pike pole with a removable point we believe will answer your requirements. The point is made in a separate piece, flat on one end and with a gimlet point on the other. A spring catch on the side of the point holds it in place when slipped into the end of the ferrule on the pole. The point may be inserted in the ferrule point first for carrying on the truck, which eliminates the hazzard of sharp projections. The gimlet or spiral point holds without slipping and it is only necessary to replace the point when it becomes excessively worn.

Q. To what depth should the new type buried wire ordinarily be installed in the ground?

A. Local conditions will govern this to a great extent though we believe that a depth of 16 to 18 inches will generally be considered adequate.

Q. What type of timber should ordinarily be used for the bottom of a line construction truck?

A. Most any kind of good hardwood could no doubt be used. However, most of the modern truck bodies can now be equipped with metal floors. These are roughened to prevent them from becoming slick. This is considered more durable and satisfactory in every way than the customary hardwood planking.

Q. What is the transmission efficiency of the newly developed high-tensile strength telephone wire for general telephone use?

A. This wire is a comparatively new development though on the several test installations we have inspected the transmission seems to compare favorably to B. B. telephone wire of equal size. One manufacturer apparently leaning toward the conservative side states that the newly developed wire has approximately 5% lower transmission loss per mile than the BB wire.

Q. Can you advise us whether there is available a machine which can be used to both backfill and tamp a trench dug for telephone conduit?

A. Such a machine is available and is known as the "Tamper-Backfiller." This machine is mounted on a tractor and equipped with catapillar treads. It may be used to push or pull dirt into a trench and tamp it firmly. The tamper strikes 45 blows per minute and has a dropping power of 380 foot pounds.

Q. It has become necessary for us to attach some steel guy wires to bridge trestle of the iron beam type. Would it be considered a satisfactory practice to wrap the strand around the steel members?

A. No we would not consider this method satisfactory. Clamps can generally be made up locally to fit over the channel iron with a bolt around which the guy may be attached with a thimble. On some types of steel structures it is possible to make use of an ordinary eye-bolt and a large square washer to attach the guy. The washer must cover two parts of the structure to hold the strain.

Q. We plan to attach a cable to a tile wall and are of the opinion we can drill holes and drop a short bolt into them with a wire attached for tieing the cable in place. Do you consider this a satisfactory method?

A. Hardly, though if you prefer to use such a method we would suggest that you purchase some regular toggles with wire ties attached. On a job of this nature we would prefer to attach 1" x 4" timbers along the location for the cable run using regular toggle bolts and then cleating the cable to the board. We have found this method to be entirely satisfactory and not overly expensive.

Q. Has there been any improvement in the design of earth boring machines for telephone work in recent years?

A. The latest type to our knowledge is of special design and mounted on the front end of a 4-ton truck which has its motor mounted in the rear. This permits all of the controls, for operating the boring machine and winch, to be placed in the drivers compartment. This new design also provides clearer vision for spotting the machine at the hole and requires only one man for operation. This truck is also equipped with spring locks which are operated from the cab.

Q. Will you tell us whether it is possible to obtain insulated type staples in various popular colors?

A. Yes, they can be obtained in white, buff, green, maroon and brown to be used to match the various colored walls. Most any telephone supply house can obtain staples in these colors for you.

RECORD TRAFFIC

made possible by the 21 features for speed with accuracy of the

STROMBERG-CARLSON SUPER-SERVICE SWITCHBOARD

Severe storms tax the facilities of a telephone exchange. Traffic jumps to a high peak, not only as the result of emergencies but also because people use the telephone for business they would ordinarily transact in person.

Such was the case on January 30, 1939, when Rochester, N.Y., experienced its worst blizzard of many years. All exchanges of the Rochester Telephone Corporation were rushed. Off-duty girls were brought back to work. But thanks to Stromberg-Carlson Super-Service Switchboards with which all Rochester exchanges are equipped, a record number of calls was handled smoothly.

A case in point was the Monroe Exchange which in 24 hours handled 138,000 calls on its 50-position "A" board, an average of between 250 and 300 calls per girl per hour, 70% of which were trunked and 90,000 calls at its 17-position "B" board where each girl averaged between 500 and 700 calls per hour. This is about 40,000 calls above the daily average.

Think what a Stromberg-Carlson Super-Service Switchboard with its 21 features for Speed with Accuracy would mean in your exchange.

Super-Service Switchboards have all the worth while time-saving features—only one ringing button for each ringing frequency to each operator position and supervision that informs the operator instantly of her next step on each connection. This is why operators can work with such speed and accuracy. Super-Service Switchboards are the ideal equipment for exchanges from 600 lines up.

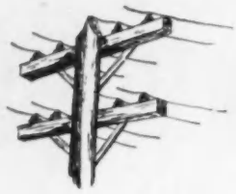
Write for Bulletin describing these 21 operating features which promote speed and accuracy.

Simplified speed keyboard construction used on Stromberg-Carlson Super-Service Switchboards. Instead of the confusing array of party line push buttons before each operator's position, there is but one push button per position for each ringing frequency.

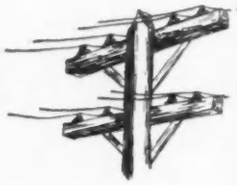
Stromberg-Carlson Telephone Mfg. Co., Factory and General Offices: 100 Carlson Road, Rochester, N. Y., U. S. A., Branch Offices: Chicago, Kansas City, San Francisco, Toronto

Stromberg-Carlson

MAKERS OF VOICE TRANSMISSION AND VOICE RECEPTION APPARATUS FOR MORE THAN FORTY YEARS



LONG LINES



R. A. Clark, Jr.

Line Impedance Theory

FROM time to time we have mentioned the impedance characteristics of lines and equipment and stressed the fact that for most efficient operation the impedance characteristics should match within a reasonable degree ie ten or fifteen percent. The impedance, as you all know, is made up of two components, resistance and reactance. The reactance may be either positive as when the circuit has in effect an equivalent of a coil and resistance in series or negative where the equivalent is a resistor and condenser in series. In most instances the reactance component is very small and the impedance is almost a pure resistance, therefore when we speak of a telephone set having an impedance of 600 ohms we mean that it is approximately all resistance.

When we speak of open wire and cable circuits there is a different phenomenon involved. This is somewhat confusing and in order to clarify the problem we will study some equivalent networks to illustrate the salient features. A telephone line, either cable or open wire, may be thought of as a network having series and shunt components. Fig. 1 represents what we mean by these designations. The resistors A-A represent the line wire series resistance. The resistance B represents the leakage and shunting capacity components. These constants are uniformally distributed along the circuit, however for simplicity of calculation we can assume they are lumped together at intervals. This assumption is valid if we make the intervals small enough; thus a long line would be built up of sections shown in Fig. 1 to form a network as shown in Fig. 2. These figures are illustrative of a ground return type telephone or telegraph circuit.

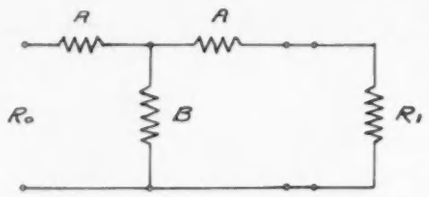


Fig 1—One Section equivalent Line.

IT so happens that a telephone line has the same impedance characteristics, provided it is terminated in its characteristic impedance at the distant end, regardless of its length. To illustrate this, suppose we take the circuit of Fig. 1 and connect a resistance R1 on the right side. Let us make R^1 equal 600 ohms, each resistance A, 200 ohms, and resistance B, 800 ohms. With this combination if we measure on the left side of the network to obtain Ro which we will call the characteristic impedance of the line, we will find that it is 600 ohms.

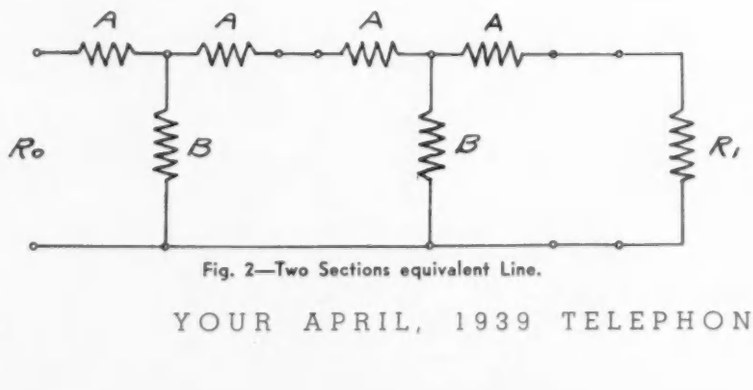


Fig. 2—Two Sections equivalent Line.

Now suppose we take the circuit of Fig. 2 and make the values of R^1, A and B the same as in Fig. 1. Upon measuring the resistance of Ro we will again find that it is 600 ohms. In other words no matter how many sections of resistance networks (A and B) are added between R1 and the terminals at which Ro is measured we will find that the value of Ro remains the same i. e. 600 ohms.

This is the situation we have on a long telephone line. Regardless of the length of line if we terminate it at the distant end with a network having an impedance equal to the characteristic impedance of the line the impedance at the near end will be the same regardless of the length of line. In actual practice there are some other factors which enter such as the effect of repeating coils and sections of cable at intermediate locations along the circuit which tend to cause variations in characteristic impedance with frequency. This was discussed in some detail in Chapter 12 of the series of articles on Telephone Transmission-Theory & Practice" which appeared in Telephone Engineer a few years ago.

Irregularities such as mentioned above may cause wide variations in the characteristic impedance of a line depending on how great the impedance mismatch is. They also effect the transmission frequency characteristics of the line thus tending to distort the voice quality. It is therefore most important on circuits which involve telephone repeaters or carrier systems that the line impedance characteristics be kept uniform and that irregularities be reduced to an absolute minimum.

I'm ashamed—but not even an elephant can remember *all* the pioneering improvements embodied in

Western Electric

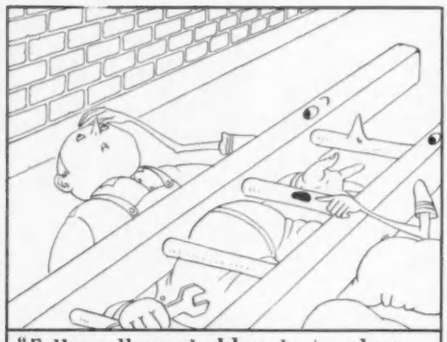
LEAD COVERED CABLE

Distributed by Graybar

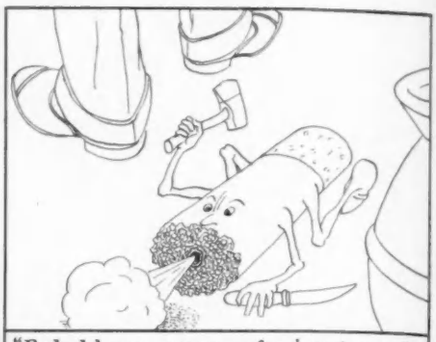
For details on Western Electric cable to meet every telephone need, write to Graybar Electric Co., Graybar Building, New York—In Canada: Northern Electric Co., Ltd.

TOO OFTEN DO WE HEAR IT SPOKEN, THAT RULES WERE MADE BUT TO BE BROKEN,
SO LET US QUOTE THIS LINE CONCISE, "A WORD TO WISE ONES WILL SUFFICE."

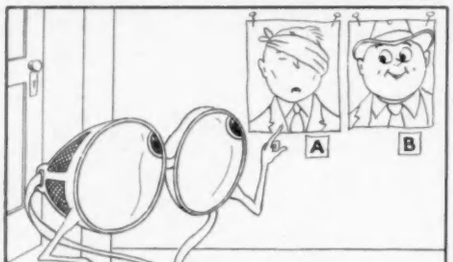
"A traffic signal I am called.
The words I spell are Stop and Go.
If I could talk you'd be appalled
At some disgraceful things I know."



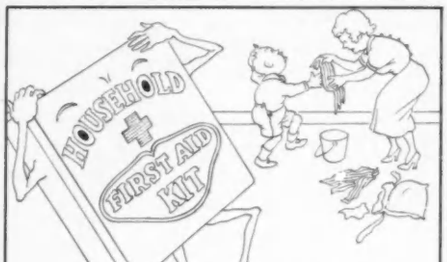
"Folks call me ladder; but unless
I have a place to brace my feet,
I often cause extreme distress
By crashing swiftly to the street."



"Behold me, once a fragrant weed;
A joy to smokers by the score.
Yet throw me down and watch the speed
With which I can destroy a floor."

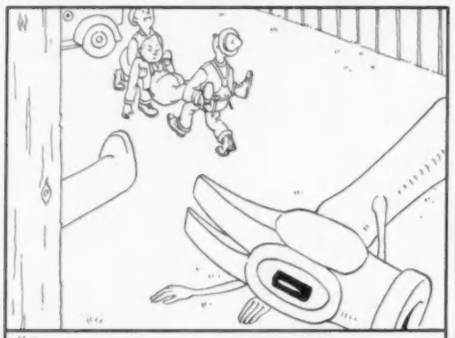


"I'm goggles --- At me do not scoff.
I stop most anything that flies.
Compare poor **A**, who took me off
With **B**, who's judgement was more wise."

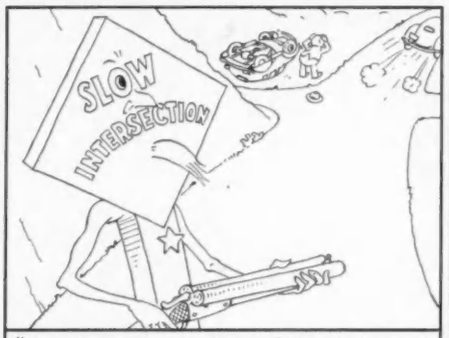


"I'm but a little household kit;
For cuts and bruises, I am told.
Ah! me, I almost have a fit
When folks don't use the things I hold."

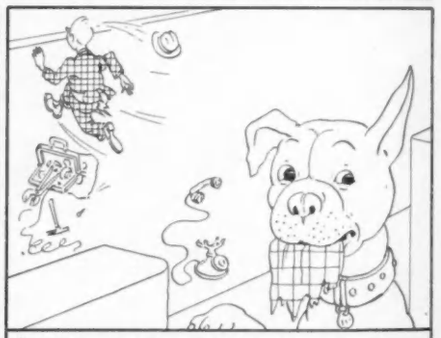
"A sturdy motor car was I.
On me a tidy sum was spent.
But he who drove me -- my, oh my!
Looked everywhere save where we went."



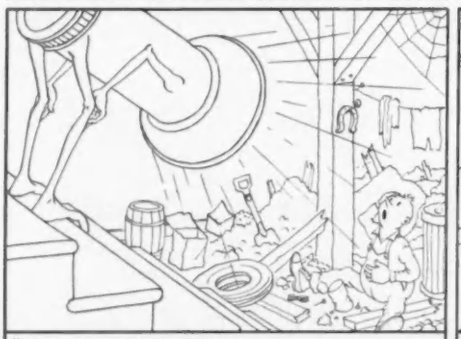
"In me you see a useful force
When held securely in the hand.
But let me drop, er--well--of course
I cannot promise where I'll land."



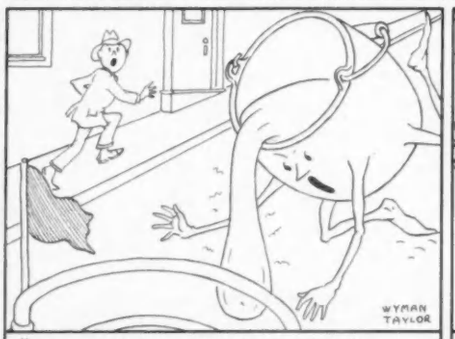
"I'm here to caution folks that speed
And boast about a record run;
But I've decided what I need
Is just a good old sawed off gun."



"My job's to keep this house secure
From early morn till late at night.
So treat me well if you'd be sure
That I won't bark or even bite."



"My name is flashlight. I'm your guide
In places dark and full of trash.
Don't fail to keep me by your side
Unless you wish a painful crash."



"For molten metal I was built.
Please watch me, that I do not spill.
And just remember, if I'm spilt,
My contents always run down hill."

"Take note--my name is poison oak.
My disposition's far from mild.
Of those that took me as a joke
I've driven millions almost wild."

"From The Pacific Telephone Magazine"

Construction of Telephone Manholes

(Continued from page 20)

Using the shovel method to mix concrete on a manhole job.

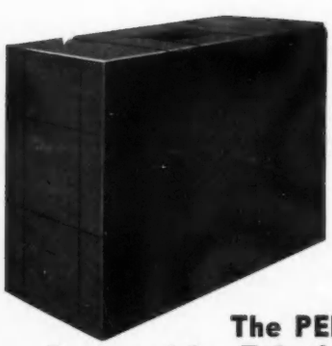
for the manhole. The tapering opening has numerous advantages over the straight walled opening formerly used. The use of the adjustable form also eliminates the necessity of constructing individual forms or the carrying in stock of several sizes of manhole collars.

Suitable fixtures should be attached to the form when it is set up in order that they will be properly imbedded in the concrete when the forms are removed. This applies particularly to pulling-in irons and cable racks. Special concrete inserts may be purchased at a small cost for use in attaching cable racks to the manhole walls. This method proves easier, quicker and better than drilling holes for them later. This type of insert is made from semi-steel and sheridized. The bolt is ordinarily U.S.S. standard and is cadmium plated. A solid end type construction prevents concrete from entering the insert ad obstructing the threads. The inserts are bolted to the steel forms before pouring and consequently the forms are easily removed after the bolts are taken out which leaves the inserts firmly anchored in the concrete flush with the wall. These inserts are usually manufactured in three sizes for 5/8", 1/2" and 5/8" bolts.

The walls of concrete manholes are usually built of 1-3-6 mix; the roof of 1-2-4 and the floor of 1-4-8. However, some use a 1-3-6 or a 1-3-5 throughout with apparant satisfaction. Service or pull-boxes are usually built of a 1-3-6 mix. The concrete should be puddled thoroughly as it is being poured to crowd the rocks away from the form to insure a smooth surface for the walls of the manhole and to make sure the inserts and fixtures are well embedded. Reinforcement rods should be used on all except the small pull-box to provide necessary added strength to the concrete. These rods are comparatively cheap and they should always be used freely especially in the roof of the manhole.

THE length of time the concrete is permitted to set in a manhole before the form is removed will depend entirely on the weather and climate. In extreme dry hot weather we have often pulled a form after setting only 24 hours with complete satisfaction. At other times it may be necessary to permit the concrete to set three days or longer in wet cold weather.

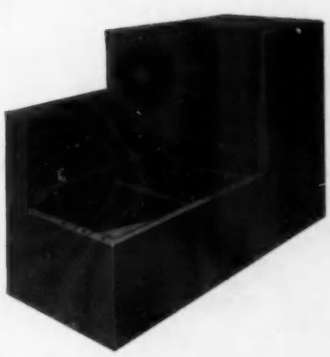
With One Set of PENOTE Sectional STEEL MANHOLE FORMS You Can Build 100 *and More* Manholes and the Only Tool You Need Is a Hammer . . . . .



- - - - and here's why. Penote (patented) Sectional forms built of husky steel reinforced with "L" angles are practically indestructible and require little maintenance . . . . they are quickly installed or removed . . . . no skilled labor is required . . . . permit pouring of manhole complete in one operation . . . . as soon as form is set up, pouring may begin and continue until the entire manhole, including roof, is completed. Penote forms can be used in loose and fluid soil. These forms are very economical and assure a smooth finished installation. They can be used in rebuilding existing manholes.

The PENOTE "UNIVERSAL" FORM Is Specially Designed for Telephone Conduit Work - - - - This form comprises ONE SET OF SECTIONS which readily build, any of the following size manholes, to A. T. & T. Company specifications: Type "A" — 3' 6" wide, 8' long, 5' 6" headroom: Type "B" — 3' 6" wide, 6' long, 5' headroom: Type "J-3" — 3' 6" wide, 8' 6" long, 5' 6" headroom: Type "J-4" — 4' wide, 8', 8' 6" or 9' long and 5' 6" headroom.

You'll find Penote Forms the one best way to construct concrete manholes. They have been thoroughly tried and tested by Public Utilities and contractors in all parts of this country and pay for themselves after use on but a few manholes. Write today for prices and details.



The CLEVELAND TRENCHER COMPANY
20100 ST. CLAIR AVE. - - - - - - CLEVELAND, OHIO
Also manufacturers of the famous "CLEVELAND" Line of Trench Excavators and Mechanical Backfilling and Tamping Machines

Erecting the sectional steel manhole form.

The form must not be pulled when the concrete is too green as there is danger of causing damage to the manhole walls, more especially around the roof opening. Likewise if permitted to set too long and dry thoroughly the forms may have a tendency to stick. This difficulty is eliminated to a great extent by greasing the forms or covering them with a coat of warm paraffin. However, we have never had any difficulty with our steel forms sticking in any type of concrete.

When manholes are located in sandy soil, holes should be provided through the concrete bottom to provide proper drainage. The floor should be sloped toward these holes. When a sewer connection is used to drain a manhole one opening should be provided in the concrete bottom to accommodate the connection. When a manhole is not provided with drains or sewer connections a sump should be provided. Sumps should be ordinarily be about 8" in diameter and 8 to 10 inches deep. Satisfactory sumps can be formed of concrete or constructed of sewer tile. When sewer tile is used the bottom of it should be well sealed with cement to prevent water from entering the manhole through it. The bottom of a manhole should slope in all directions toward the sump so that the floor will drain dry. The principal function of a sump is to form a pocket in which to place the end of the manhole pump in order that it will be able to suck it dry.

Occasionally we hear the remark made by individuals that they do not favor the use of concrete in manhole construction due to the difficulty of providing material on the job in the comparatively small quantities required at each manhole. *No doubt that in the old days this was true but such is not the case today.* Small power driven concrete mixers may now be purchased or rented at a reasonable cost or concrete may be mixed by hand by turning with shovels on a board. When the small mixer is used it may be set up at each manhole or at some central point and the mixed concrete transported by some convenient means to the various locations required.

Most fairly large towns at the present time have concrete plants where ready-mixed concrete may be purchased by the yard. This concrete is generally delivered in mixer type trucks with suitable spouts for conveying it directly into the manholes. In cold weather heated concrete may be purchased from these companies at a slight increase in cost. There is no doubt but that this is the ideal means of constructing manholes and it should always be taken advantage of when available as it will reduce labor costs considerable. This method, when used with the sectional steel manhole forms, makes an ideal combination, which should be appreciated by all telephone men in these times of depression.

GOVERNMENT TELEPHONE CENSUS FOR 1937 RELEASED

THE number of telephones and the operating revenues of telephone companies in the United States increased more than eleven percent between 1932 and 1937, according to preliminary figures compiled from returns of the recent quinquennial census of electrical industries, released by Director William L. Austin, Bureau of the Census, Department of Commerce.

The 1937 census of telephones was limited to public telephone systems and lines operated within the continental United States and did not cover the following: Lines operated by the Federal, State, or municipal governments; certain private lines—for example, those used exclusively by railroads for dispatching and operating trains and those connecting branches or departments of manufacturing or mercantile establishments, hotels, mines, and lumber camps, etc. In addition, data for 11,759 connecting lines having fewer than five telephones per line were not included in the detailed summaries and tabulations.

According to the returns received from 38,801 systems and lines plus data for the connecting lines having fewer than five telephones, the toal number of telephones in use in the United States on December 31, 1937, was 19,453,401 compared with 17,424,406 on December 31, 1932, an increase of 11.6 percent. Telephone operating revenues increased 11.2 percent, from $1,061,530,140 in 1932 to $1,180,082,372 in 1937.

Although the number of employees (reported for June 30) showed a slight decrease of three-tenths of one percent, the salary and wage payments increased 12.8 percent during the same period from $458,116,667 to $516,640,009.

The principal statistics for the public telephone systems and lines in the United States, for 1937, 1932, and 1927, are summarized in Table 1. Table 2 presents statistics for operating companies, grouped according to annual operating revenues, and for connecting lines and systems (those lines owned independently of the operating company supplying switchboard service.) All figures for 1937 are preliminary and subject to revision.

Table 1.—Principal Statistics—All Systems and Lines: 1937*, 1932, and 1927

	1937	1932	1927	Percent of increase or decrease (—) 1932-1937	1927-1932	1927-1937
Number of telephones, total	33,618,333,461	30,048,165,513	31,614,172,621	—13.4	—25.5	—35.5
Number of systems and lines	38,801	44,828	60,148	—13.4	—25.5	—35.5
Miles of single wire	90,787,172	87,677,586	63,836,182	3.5	37.3	42.2
Number of central offices[1]	18,967	19,228	20,227	— 1.4	— 4.9	— 6.2
Number of telephones, total	19,424,200	17,424,406	18,522,767	11.5	— 5.9	4.9
Residence	12,349,933	11,089,946	12,128,617	11.4	— 8.6	1.8
Business	7,074,267	6,334,460	6,394,150	11.7	— 0.9	10.6
Number of calls (originating with systems reporting)[1]	33,618,323,461	30,048,165,513	31,614,172,621	11.9	— 5.0	6.3
Number of employees:[1]						
At close of June	333,162	334,085	375,272	— 0.3	—11.0	—11.2
At close of year	325.943	(2)	(2)	.....	.....	.....
Salaries and wages[1]	$516,640,009	$ 458,116,677	$ 486,597,070	12.8	— 5.9	6.2
Operating revenues[3]	$1,180,028,372	$1,061,530,140	$1,023,573,567	11.2	3.7	15.3
Investment in plant and equipment	$5,000,456,220	$4,791,902,525	$3,548,874,716	4.4	35.0	40.9

*The figures for 1937 do not include 11,759 connecting lines having less than 5 telephones per line. A total of 29,201 telephones was reported for these lines. Estimated figures for other items are as follows: 27,694 residence telephones; 1,507 business telephones; 44,249 miles of single wire; $1,599,615 investment in equipment. Similar data for this class of lines, which are included for 1932 and 1927, are not available for those years.

[1]Not applicable to connecting lines.

[2]Not called for on schedule.

[3]Includes assessments levied by mutual operating companies and mutual connecting lines for operation and maintenance of systems and lines.

(Please turn to page 38 for Table 2.)

DORSON'S *Toll Timer* WILL BE

AT THE STATE CONVENTIONS

•

Foolproof

•

Unconditional Guarantee

•

40 Hour Lever Movement

•

$22.50

Look for Dorson's Toll Timer in your supplier's exhibit. Just as you can help the Association by attending, so can the Toll Timer help you eliminate subscriber arguments over toll calls. Many in the telephone field are singing the praises of Dorson's Toll Timer.

Write your supplier today.

DORSON CORPORATION

MFG'S OF TIME STAMPS, SWITCHES & WATCHMEN'S CLOCKS

—— OVER 25 YEARS OF SERVICE ——

605 Washington Blvd. Chicago

FROM PINS TO POLES!

—Graybar supplies every pole line item a telephone company needs

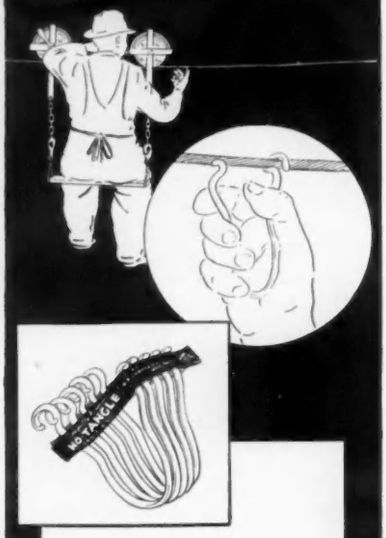
Hundreds of different items . . . items originating in many parts of the country . . . must be ordered and assembled before a pole line can be built.

Telephone company buyers can greatly simplify this task by going to *one* convenient source of supply . . . Graybar . . . for *all* pole line items. Whatever the items . . . poles and cross-arms . . . wire and cable . . . labor-saving tools . . . heavy construction equipment . . . underground materials . . . you'll find them—and many others—conveniently available through a nearby Graybar warehouse.

You'll find, too, that supplies from Graybar are dependable supplies. Behind every product stands a Graybar reputation for reliability that goes back 70 years to 1869.

OFFICES IN 83 PRINCIPAL CITIES. EXECUTIVE OFFICES: GRAYBAR BLDG., N.Y.

NO-TANGLE
CABLE RINGS



Make Cable Hanging Easier and Better.

A "Simple little twist of the wrist," and they're on — that's about all there is to the installation of No Tangle Cable Rings, because they are so designed that the spiral hook wraps itself around the messenger and permits a leverage action that practically eliminates the necessity of gripping. The package, too, is an aid to installation, because rings are held firmly together so they cannot turn, twist or tangle, and being packed in boxes, they are easily stocked and identified.

Once on the line, No Tangle Rings don't slip, swing or jump, because the spiral hook grips the strand tightly and the shoulder on the short hook prevents jumping up. The smooth rounded bearing surface makes it easier to pull cable through No Tangle Rings without cutting or binding and prevents excessive sheath cutting after the job is done.

Every No Tangle Ring is individually inspected and checked for rough protuberances that cause sheath wear. Every ring has a smooth galvanized finish.

Consider all these features, compare them and you will specify No Tangle Rings on your next order.

A·B·CHANCE CO·
CENTRALIA, MISSOURI

Table 2.—Summary—Operating Companies Grouped According to Annual Operating Revenues, and Connecting Lines: 1937

	Total	Reporting annual operating revenues of $10,000 or more	Reporting annual operating revenues less than $10,000
Operating Companies			
Number of companies	6,694	846	5,848
Miles of single wire, total	90,323,459	89,571,035	752,424
In cable	83,457,378	83,378,183	79,195
Not in cable	6,866,081	6,192,852	673,229
Central offices, total	18,967	12,539	6,428
Dial systems	1,847	1,799	48
Other types	17,120	10,740	6,380
Number of telephones, total	19,029,813	18,291,184	738,629
Served by:			
Dial system	8,485,899	8,480,280	5,619
Other types	10,543,914	9,810,904	733,010
Residence telephones	11,966,287	11,325,865	640,422
Business telephones	7,063,526	6,965,319	98,207
Calls originating with systems reporting, total	33,618,333,461	32,932,124,009	686,209,452
Exchange (local calls)	32,612,715,983	31,951,700,652	661,015,331
Toll and long distance	1,005,617,478	980,423,357	25,194,121
Employees:			
Close of June, total	333,162	319,950	13,212
Male	129,722	124,464	5,258
Female	203,440	195,486	7,954
Close of year, total	325,943	312,898	13,045
Male	128,478	123,331	5,147
Female	197,465	189,567	7,898
Salaries and wages	$ 516,640,009	$ 510,694,592	$ 5,945,417
Telephone operating revenues[1]	$1,179,323,785	$1,167,441,596	$11,882,189
Local service revenues[1]	$797,723,675	$789,395,375	$8,238,300
Toll service revenues[1]	$350,760,807	$348,309,171	$2,451,636
Taxes assignable to operators	$148,605,287	$148,005,063	$600,224
Investment in plant and equipment	$4,981,609,833	$4,941,286,012	$40,323,821
Interest income	$4,520,084	$4,501,081	$19,003
Interest paid on funded debt	$42,387,546	$42,305,976	$81,570
Connecting Lines and Systems[2]			
Number of systems or lines	32,107	.....	.....
Miles of single wire	463,713	.....	.....
Number of telephones, total	394,387	.....	.....
Residence	383,646	.....	.....
Business	10,741	.....	.....
Total receipts[3]	$704,587	.....	.....
Investment in equipment	$18,846,387	.....	.....

[1]The figures for "local service revenues" and "toll service revenues" will not add to the totals shown for "telephone operating revenues" as the latter include service revenues, toll service revenues, and miscellaneous telephone operating revenues (not separately called for on schedule), **less uncollectible operating revenues.** These totals also include the amount of assessments levied by mutual companies for operation and maintenance.

[2]Not including 11,759 connecting lines having less than 5 telephones per line. A total of 29,201 telephones was reported for these lines. Estimated figures for other items are as follows: 27,694 residence telephones; 1,507 business telephones; 44,249 miles of single wire; $1,699,615 investment in equipment.

[3]Includes assessments levied by mutual lines for operation and maintenance.

Telephones Record Flood Levels

Albert L. King, hydologic supervisor, River and Flood Division, Weather Bureau, Washington, D. C., is making a trip to cities along the Ohio River and to a number of stations along the Mississippi River relative to the installation of telephonic water level indicators by which flood stages may be read.

Through these instruments a number is dialed at the weather bureaus and through automatic agencies the height of the river can be determined.

King said that the instruments would be installed at Cairo, Ill., and Memphis, Tenn., but none would be installed at Cincinnati since a tele-recorded system here gives a continuous record of the river stages.

Only four of the telephonic water level indicators of the instruments have been installed in the country so far, King said.

Unified Service for Tarkio, Mo.

For more than thirty-five years the citizens of Tarkio, Missouri, witnessed a telephone fight between the Southwestern Bell Telephone Company and the Atchison County Mutual Telephone Company. So bitter was the feeling that it was necessary for a third party to effect a consolidation. After a long period of negotiation, A. J. Roberts, of Kansas City, Missouri, was able to buy the competing plants.

Tarkio is located in Atchison County, which is considered one of the richest agricultural sections in Missouri.

In order to effect a consolidation a three position Junior Multiple Stromberg-Carlson board was installed and unified service inaugurated February 1st. The Tarkio Exchange serves more than 700 subscribers and is a toll center.

"Tapping In" on Washington

(Continued from page 18)

the needs of the growing toll traffic. The coaxial cable also is particularly important in remedying the conditions which occur in that region due to severe sleet storms. Television transmission can be obtained later when needed through the installation of higher powered repeaters. The installation of the cable for public use will be completed in 1941.

Administrator Andrews Issues Statement on Telephone Exemption

RECOGNITION of the value of the telephone in rural areas was given by Wage-Hour Administrator Andrews in a statement to the Senate and House Labor Committee Chairman endorsing the 350-station exemption. The statement, which was lengthy and detailed in its exposition of the needs of the Independent telephone industry to be relieved from the financial burdens of minimum wages and maximum hours of work, evidently was designed to cite to other industries that the Wage-Hour Administration was not disposed to give any exemptions under the law without full justification.

Administrator Andrews viewed the telephone industry as a decent place to work without any "sweatshop" characteristics—he cited that there was no competition in the industry between companies serving the same communities—the exemption, he stressed, was proper because the small exchanges served agricultural and rural regions which received exempting provisions under the law. The 350-station exemption will eliminate the agency of exchanges from the burden of the Wage-Hour law.

But Administrator Andrews in his statement tried to put forward his best arguments in defense of the 350-station exemption because the Wage-Hour Division is naturally loath to back any relief proposals for a single industry without full justification so as to prevent the opening of flood gates for other industries to seek similar legislation. Administrator Andrew cited that the Wage-Hour Division had found an exemption level of 250 stations in its first determination but decided to add an extra 100 stations as a precautionary margin of safety. Through his 350-station exemption the so-called "part-time" class of exchange dropped out of the picture, he cited.

Although Administrator Andrews cited that exchanges serving more than 350 telephones generally lose the predominately rural character present in smaller exchanges, the figures of the United States Independent Telephone Association show that in the Agricultural Middle West states rural towns and countryside have exchanges with an average of 500 or 750 stations.

● **The Wage-Hour Committee of the U. S. Independent Telephone Association during the course of discussions of the telephone exemption amendment in March in a statement emphasized that the organization was not opposing the purposes of the Fair Labor Standards Act but was doing everything possible to bring about liberal wages and reasonable hours. But for the smaller exchanges too burdensome wages and hours would result in curtailment of service and reduction in employment, as well as a trend to mechanization. The National Association pointed out that there was a ceiling to rates which could be obtained in rural areas and if rates are raised beyond that point telephones are lost and with the reduction in telephones fewer people will be employed.**

The important portions of the statement of Administrator Andrews were as follows:

THE Wage and Hour Division recommends the enactment of Section 7 of the bill which provides that the wage and hour provisions of the Fair Labor Standards Act of 1938 shall not apply with respect to any switchboard operator employed in a public telephone exchange with less than 350 statitons. This recommendation is based upon a study, undertaken by the Wage and Hour Division, regarding the problems of telephone exchanges under the Act. In reaching this conclusion, careful consideration was also given to the other amendments exempting employees of telephone companies from the coverage of the Act which have been introduced during the present session of Congress. The bases of such other exemptions vary considerably. One amendment exempts employees of telephone exchanges having one thousand subscribers or less; another grants an exemption if the company does not operate more than 500 telephones in the entire system; still another authorizes the Administrator to issue special certificates exempting employees of telephone exchanges pursuant to Section 14. One the basis of the cumulative weight of all the information disclosed by our study the Wage and Hour Division considers that the enactment of Section 7 of the bill would not be inconsistent with the purposes of the Fair Labor Standards Act.

Reasons for an Exemption

"I. An exemption for the small tele-

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Thousands of your subscribers have a definite need for these new communication devices.

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YOUR INVESTMENT IS EXTREMELY SMALL . . . THE INSTALLATIONS ARE SIMPLE . . .

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phone exchange is necessary in order to insure uninterrupted telephone communication service for the farmer and for the small rural community. In the marginal fringe of the telephone industry our study has indicated that the applicability of the Fair Labor Standards Act would probably result in the discontinuance of operations or the substantial curtailment of 24-hour service. Small rural telephone companies on the whole are unable financially to comply with the wage provisions of the statute.

"2. An amendment exempting switchboard operators of small telephone exchanges from Sections 6 and 7 will preclude the necessity of costly litigation to ascertain whether such employees are presently within the coverage of the wage and hour provisions of the Act. It may be argued as a matter of legal interpretation that an exemption for small telephone exchanges serves merely to clarify rather than effect any substantive change in the status of such exchanges under the Act. This question, however, can only be decided by the courts and an adverse decision would be disastrous to the small telephone exchange.

"The wage and hour provision of the Act apply with respect to employees engaged in interstate commerce or in the production of goods for interstate commerce. Whether an employee is so engaged depends of course upon the facts in the particular case. The Wage and Hour Division has not expressed any opinion as to whether any or all of the employees of small telephone exchanges which transmit interstate long-distance calls very infrequently, are engaged in interstate commerce. Many of the small exchanges are located in rural areas or in small villages and arrange for connecting facilities with the Bell System for toll calls. It seems legally doubtful to consider an employee who puts through an average of one interstate call a week or every two weeks as being engaged in interstate commerce within the meaning of Sections 6 and 7. On the other hand, since any of the subscribers of the company may at any time pick up his telephone and put through an interstate call, and since the number of interstate calls may vary from day to day and from week to week in particualr exchanges, no definite assurance of non-coverage is possible. Therefore, in the absence of controlling judicial precedent, the Wage and Hour Division has refrained from expressing an opinion as to the coverage of the Act. Moreover, any opinion expressed by the Wage and Hour Divisoin would not relieve the company from possible liability in a suit brought by an employee under Section 16(b) to recover unpaid minimum wages.

Conditions of Telephone Exchanges Not Sweatshop Work

"3. The small telephone exchanges do not involve conditions of sweatshop employment and furthermore would create extremely difficult administrative problems of enforcement. These exchanges are generally located in a home in the community or in a local store where the operation of the board is incidental to other work. Generally, the contracting agent is furnished with living quarters, heat and light, and is required to give the switchboard whatever attention is needed. The operator frequently engages in other work and often supplements her income from such other work.

"With regard to enforcement, the computation of hours for which operators of small exchanges are entitled to compensation presents a very difficult problem. Thus in many of such exchanges the telephone requirements are largely confined to an hour or two in the morning, a similar period about noon and two or three hours in the evening. At other times during the day calls are very infrequent. During the night no one is in direct attendance at the board but an alarm bell rings the operator in the event of emergency calls. On the other hand, the operator is on duty and is required to remain subject to call at all times.

Should Be Exempted Because of Agricultural Character

"4. The small telephone exchanges are located in rural areas or in very small towns and most of the telephones served by such exchanges are located on farms or in small communities. Since the Act generally exempts agricultural and rural occupations, an exemption for the small telephone exchanges may reasonably be considered necessary to supplement the general agricultural policy of the Act.

"5. An exemption for certain telephone exchanges will not tend to depress wage rates paid to employees in the remainder of the telephone industry. In this respect the telephone industry must be sharply distinguished from other types of business. Thus, whereas an exemption for a small textile company might, by reason of competition in the same market, tend to depress wages paid by non-exempt textile companies, this result would not occur in the telephone industry because there is no competition among exchanges for the same subscribers.

Margin of 350 Stations Deemed Proper Safeguard

"The correctness of the suggested criterion of 350 stations as a basis for exemption is not, of course, subject to precise mathematical demonstration but calls for the exercise of judgment based upon the information available. The line should be drawn at a point which on the whole would meet the principal difficulties encountered by the telephone industry under the Act and at the same time not make the exemption so broad as to exclude from the coverage of the Act parts of the industry which do not appear to merit exemption. In our opinion, the available data would provide ample justification for drawing the line at 250, but an extra 100 stations might well be added as a precautionary margin of safety.

"In testing the financial effects of the applicability of the Fair Labor Standards Act upon telephone exchanges, the overtime provision should be disregarded and the wage rate should be considered as 30c an hour (the minimum wage rate which becomes effective October 24, 1939). No overtime need be considered because it is unnecessary, as a practical matter, to employ telephone operators for a period longer than the minimum period specified in the statute. Additional operators are readily available for service and continuous operation may be provided by working the operators in shifts. With respect to the wage rate, although it is true that the Act contemplates an eventual minimum wage rate of 40c an hour, the Administrator is given power to promulgate wage orders for individual industries providing for an applicable wage rate at less than 40c an hour (but not less

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than 30c an hour) if such action is necessary to prevent curtailment of employment.

"If the exemption is limited to exchanges serving 350 telephones or less the part time class of exchange described above drops out of the picture. The Act would then be limited to telephone exchanges which are operated on a truly commercial basis with full time employees who engage in no supplementary activity. Moreover, exchanges serving more than 350 telephones generally lose the predominately rural character which is present in the case of smaller exchanges.

State Commissions Failed to Give Reasons

"In the course of our study we requested all of the state public service commissions to give us the benefit of their expert opinions as to the desirability and scope of an exemption for telephone companies. The replies indicated that an exemption is necessary to preserve uninterrupted telephone communication service and a majority suggested an exemption for exchanges having 1000 subscribers or less.

We do not recommend this suggested figure of 1000 because our own independent investigation indicated that a smaller exemption would be adequate in the light of the requirements of the Fair Labor Standards Act and we had no knowledge of the reasons upon which the opinions were based.

"Section 13 (a) (2) of the Act provides that the wage and hour provisions shall not apply with respect to any employee engaged in any retail or service establishment, the greater part of whose selling or servicing is in intrastate commerce. In our Interpretative Bulletin No. 6 which deals with this exemption, we stated that in our opinion telephone companies (as well as banks, insurance companies, dry dock companies, advertising agencies, etc.) are not to be considered service establishments within the meaning of this section. After long study we indicated that the term "service establishment" as used in this exemption, referred to an enterprise similar to a retail establishment but not accurately classified as such. We do not favor any amendment exempting certain telephone exchanges by the altering provisions of Section 13 (a) (2) so as to include telephone exchanges within the meaning of service establishments. Such action would create unnecessary and difficult problems of legal interpretation as to the meaning of Section 13 (a) (2) and would require a complete re-examination of the interpretation of that section. Section 7 of the bill avoids such difficulties by adding a new sub-section (11) to Section 13 (a).

We do not favor the amendment which

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has been introduced and which grants an exemption with respect to employees of telephone exchanges upon the issuance of a special certificate by the Administrator pursuant to Section 14 of the Act. Our study has indicated that employees of very small exchanges would in most cases be entitled to the exemption in order to avoid curtailment of employment. To carry out the administrative duty of issuing such certificates, would require a complete investigation of the same material which state public service commissions are required to investigate in order to establish rates. Moreover, the administrative problem of granting special certificates would delay immediate correction of the acute problem faced by the small telephone exchange under the Act".

Independent Has 54th Anniversary

The (Kan.) Telephone and Telegraph Company is observing in a quiet way its 54th anniversary. It is the oldest independent telephone company in Kansas. It was organized in 1885 by George W. Crawford who operated it until his death in 1915.

The company has 65,000 feet of cables in Girard, Cherokee and Arma. These cables consist of 303 pr, 202 pr, 151 pr, 101 pr, 76 pr, 51 pr and 26 pr cables. The system has four thousand poles and 150 miles of toll line in Crawford and Cherokee counties.

These properties have been entirely rebuilt and the equipment and telephones all changed since 1923. There has been over $150,000 worth of material and labor put in since 1923. The buildings have all been remodeled.

The company has taken over the management of the Western Union in all its exchanges and furnishes 24-hour Western Union service.

The Crawford Telephone Company owns toll lines in Cherokee and Crawford counties and connects with all towns in these counties. It makes connection with the Southwestern Bell Telephone Company and has their lines on its switchboards at Girard and Cherokee; and also the Kansas Telephone Company. They have 238,000 miles of wire lines.

Phones Gain in Canada

Canada ranks 5th among telephone-using countries. She has the highest per capita number of telephone conversations and stands second only to the United States in the number of telephones in proportion to population, says the Canadian Pacific.

Four other countries—the United States, Germany, Great Britain and France, all with much greater populations—have a larger total number of telephones in use. Returns now have been published for Canada for 1937 and show gains in the number of telephones and in both expenditures and revenues. The net revenues likewise have increased.

The number of telephones in use in Canada in 1937, as reported by the government statistical service, was 1,322,794, as compared with 1,266,228 in 1936. The number of telephones for each 100 of the population rose between these years from 11.48 to 11.89.

R.E.A. Trouble

Due West (S. Car.) Telephone exchange will be permitted to discontinue its free service between Abbeville and Due West under provision of an order announced March 19, by the state public service commission. The exchange had petitioned for authority to do this.

It was contended in the petition that the free line had become almost useless since the construction of a parallel rural electrification line, interference from which made the telephone service poor.

The exchange will continue its pay line from Due West to Abbeville. It is not close enough to the electric line to be affected.

Spanish War Damage Estimate

According to press reports, the damage done to physical plant of the Spanish Telephone Company as a result of the civil war is about ten per cent of the total value of the property and has been confined largely to open wire circuits. All four exchanges in the Barcelona area were undamaged during the bombardment and capture of that city.

Chicago Engineer Sells Patent Interest

Harold J. McCreary, consulting engineer of Chicago, has sold to Eclipse Aviation, a subsidiary of Bendix Aviation, his interest in inventions of cathode ray compass, No. 2025580 & 2027399.

It was discovered that the cathode rays produced in a vacuum tube were deflected by the magnetic field of the earth, such as the cathode rays of the upper atmosphere (usually known as the Aurora Borealis) are deflected by the earths magnetic field. This was applied to the construction of a practical compass for aviation purposes.

New Address

The Commercial Cord & Supply Company formerly of Rochester, N. Y., is now located at Clifton Springs, N. Y.

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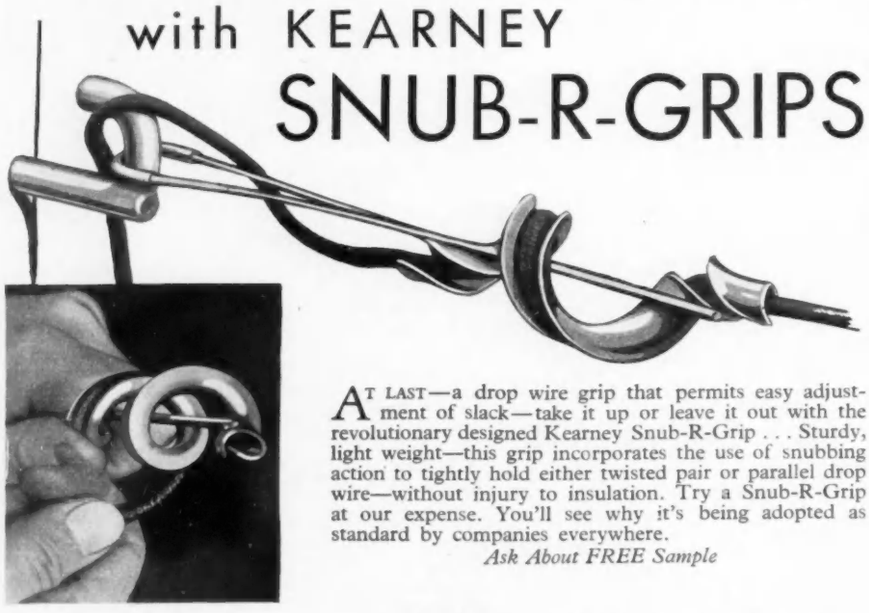

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Cable Corrosion

(Continued from page 23)

conditions near "C" showed the highest positive tendency which was apparently about the neutral balancing point between the city and interurban line track potentials. Under the new track conditions this point shifted to a location near "J." This condition probably due to a reversal of track drop in this area under the 1914 set-up. While this condition was shown to be true on the telephone cable systems, it seemed probable that a similar condition might exist on the pipe line systems although the territory covered by these pipe systems was several times greater than that of the cable systems, and the pipe leakage was correspondingly greater. Any such condition however might be corrected when desired, by changes in the insulated return feeder arrangements. High negative conditions of cable-to-earth in the northern and eastern ends indicated effects of poor interurban track bonding caused by lines in the southern part of the city. These facts were later proven to be correct when track tests were made in the railway study.

Condition (m) These curves showed one condition of a DRAINAGE wire to the **interurban sub-station** or west end (w) of the telephone underground. This cleared several cable-to-earth positive conditions at this end, and generally lowered all positive conditions. Several values of drainage wire resistances were also tried.

Condition (1) These curves showed one condition of a DRAINAGE wire to the **city lines power house** or east end (e) of the telephone underground. This cleared cable-to-earth positive conditions at this end but tended to increase positive conditions in the central and west ends. Several values of drainage wire resistance were also tried. It was found that the high resistance gave best results while the low resistance gave excessively high negatives-to-earth readings and steep cable potential gradients.

Condition (n) These curves showed the condition of both DRAINAGE wires as described under (m) and (1), connected at the same time. These were made with NO RESISTANCE in the drainage wires and cable-to-earth showed negative values as high as two volts, which were excessive with respect to surrounding metallic structures. Resistances of 2.5 and 2.35 ohms respectively were used in the east and west DRAIN wires. Under this condition it was impossible to clear all positive conditions near the interurban drainage end (w) undoubtedly due to poor track conditions and it was necessary to try a third drainage wire.

AUTHOR'S COMMENT. Here is a typical case where if a properly designed BOOSTER RECTIFIER had been available, a long series of expensive tests would have been eliminated and all positive conditions could have been cleared by relatively small amounts of FORCED DRAINAGE.

Condition (o) These curves showed the conditions with THREE DRAINAGE wires, one to the interurban power sub-station, as described under (m) above; one to the city lines power house as described under (1) above; and a third one to an insulated railway return at (n) near the center of the city. This was not the best location as this drain was to relieve interurban leakage, but practical tests showed this to be the only return connection available with anywhere near the necessary voltage-drop. Various combinations of these three drainage wires were tried and the best condition was with 3.5 ohms at "E," 1.7 ohms at "W" and no resistance at "N." This however left undesirably high negatives-to-earth with positives part of the time at some locations.

AUTHOR'S COMMENT. Here again is a typical case where if a properly designed BOOSTER RECTIFIER had been available, high negatives could have been reduced and positive conditions cleared by properly balanced FORCED DRAINAGE and thus eliminated expensive tests. The maximum total drainage of these three connections was approximately 27 amperes or 10% less than that of the two drainage wires which cleared the system in 1911. The 1911 current was approximately 1% of the combined railway output, and that of the three 1914 drainage wires was approximately ½ of 1% of the total railway output. More than 50% of the total drainage was caused by interurban lines although total lengths of city lines tracks and their total loads were much greater. Poor track bonding was the cause which was definitely proven by later tests which showed that when interurban cars entered the city limits, the higher drainage values occurred.

This drainage condition was later improved by the installation of an automatic reverse current relay in the drainage at "W."

(TO BE CONCLUDED)

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COL. BLAIR JOINS AUTOMATIC ELECTRIC TECHNICAL STAFF

Colonel William Richards Blair, prominent physicist and research technician, for many years active in the service of various departments of the United States Government, has joined the technical staff of Automatic Electric Company, for whom he will act in an advisory capacity on matters of technical and scientific importance. Col. Blair recently retired as director in chief of the Signal Corps Laboratories of the United States Army, which position he had held continuously since 1930.

Col. Blair received his early education in the public schools of Kansas and Wisconsin, coming to Chicago in 1900 to attend the University of Chicago, where he received his B. Sc. degree ('04). He followed this with two years of post graduate study at the same university as a result of which he was awarded his Ph. D. degree.

In 1906, he joined the service of the United States government and was appointed research director of the Mount Weather Observatory, in Virginia. As

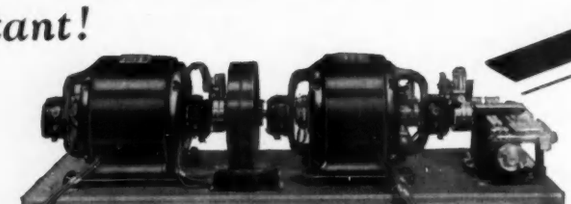
COL. W. R. BLAIR

a result of his extensive technical investigations during this period, he became a recognized authority on upper air research, contributing to the literature of this and kindred subjects in government publications and in scientific periodicals. In 1914, the rising importance of commercial and military aviation further stressed the need for aerological research, and accordingly he was appointed chief of the division of aerological investigations of the United States Weather Bureau. In 1917, he was commissioned as major in the U. S. Signal Corps, serving as officer in entire command of the meteorological section of the American Expeditionary Forces in France. In 1919, he became lieutenant-colonel.

In the years after the war, Col. Blair was engaged in various technical capacities for the Signal Corps, including the direction of various Signal Corps personnel training activities, and he engaged also in communication research and engineering in the office of the chief signal officer. In 1930, he was appointed officer in charge of the Signal Corps Laboratories, Ft. Monmouth, N. J., which office he continued to hold until last year. During this period he directed technical investigations of a wide variety of communication methods and apparatus, and in addition engaged in extensive investigations in the field of pure physical research with special reference to practical communication problems.

(See bottom of adjoining column)

Important!



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"National" Offers Sign Brackets

Recent refinements in the design and construction of "National" Sign Brackets are announced by the National Telephone Supply Company of Cleveland, Ohio. Practically every type of metal sign can be quickly, securely, permanently and neatly hung to wood, concrete or metal pole or pipe posts at a minimum cost with these very efficient National Galvanized Sign Brackets.

These brackets are made in two models, No. 170 National Galvanized Sign Bracket for pipe post or metal poles, and the No. 188, for attaching to wood poles, trolley poles, or metal or concrete white way poles and other straight or tapering standards which are 4" outside diameter and larger.

The use of "National" sign brackets eliminates the necessity for boring holes in posts. The special formation of bracket head, holds the sign away from post and permits convenient access to mounting bolts. These brackets project the signs well out from posts assuring maximum visibility. A descriptive bulletin is available at no cash by addressing the National Tel. Supply Co. or through the editor.

Col. Blair has served on various government commissions relating to the international aspects of communication, and he now holds membership in a large number of technical societies; including the Geophysical Union; Physical Society; Society of Aeronautical Engineering; Philosophical Society of Washington; Washington Academy and the Royal Meteorological Society.

Because of his long association with the Signal Corps, and his consequent extensive experience in communication research, Col. Blair brings to the Automatic Electric organization an intimate knowledge of communication problems, which should prove of the utmost value in furthering the Company's rapidly expanding activities in the design and manufacture of equipment for both government and commercial applications.

Wire Booklet Available

Long-span, lower-cost construction, utilizing a new and efficient high-tensile, low-resistance galvanized wire, is rapidly becoming an important factor in the economic building of rural telephone lines.

The Indiana Steel & Wire Company, Muncie, Indiana, pioneers in the development of high strength telephone wire, have just published a booklet containing pertinent engineering data and valuable suggestions and information on construction practices.

This book, which is available to telephone companies upon request, is built around Crapo HTL-85, the new high-tensile, low-resistance line wire perfected by Indiana Steel & Wire Company after more than ten years of research. The practical application of this wire now has been demonstrated over a long period by extensive and exhaustive field tests.

Part 1 of this technical booklet describes the improved physical characteristics and transmission efficiency of Crapo HTL-85. The tensile strength of this wire is shown to be approximately 60 per cent greater than that of standard B. B. wire. Transmission losses, expressed in decibels per mile at 1000 cycles per second with currents at normal voice-frequency magnitude, are less than those of B. B. wire.

The superior strength of Crapo HTL-85 offers economical and practical advantages in two types of application. One application provides for longer spans with fewer pole structures per mile. The other provides for stronger spans, with increased factor of safety.

The book includes tables showing the recommended sags for Crapo HTL-85 Line Wire in long-span construction for the three loading districts as well as tables of sags when this wire is used on

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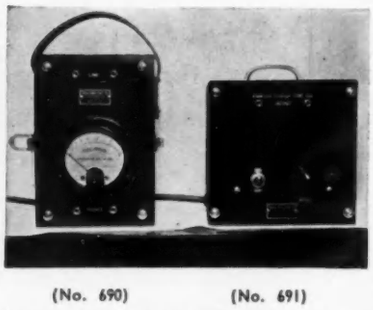

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lines of ordinary span lengths.

Part II of the booklet presents, both in text and illustration, the new standards of construction recommended for Crapo HTL-85. This section includes valuable information on ties, dead ends, electrical connectors, pole grounds, splicing sleeves, etc., along with eight full-page drawings showing various phases of construction which can be used to advantage in the building of lines.

A copy of this booklet, Bulletin No. 201, may be obtained by writing Indiana Steel & Wire Company, Muncie, Indiana.

Cook Electric Presents New Product

A new protected cable terminal, the S-20, has been announced by Cook Electric Co., Chicago, manufacturers of telephone terminal and protection equipment.

The S-20 is a newly designed, pressed steel terminal, in a hot galvanized finish. It is light in weight but extremely rugged and durable. Insulation is of hard rubber and Bakelite. The cable enters the moisture-tight cable chamber through the Cook self-soldering nozzle which is placed well to the rear of the terminal to bring the cable to the pole.

The pure zinc cover of the cable chamber is placed directly at the front of the terminal, thus making the cable connections on the inside of the cable chamber readily accessible while the terminal is in service.

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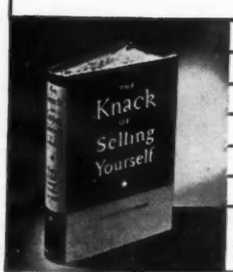

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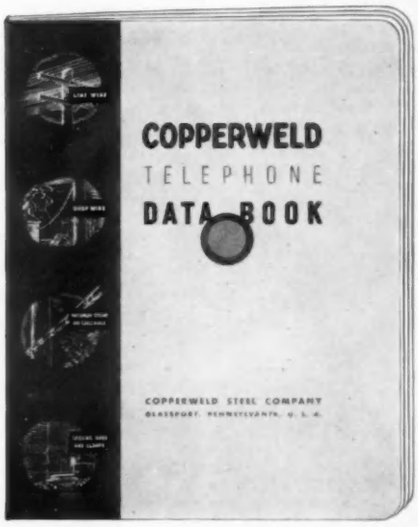

well illustrated and contains many valuable graphs and tables, construction suggestions and other interesting material. If you haven't received your copy, write to the COPPERWELD STEEL COMPANY, GLASSPORT, PENNSYLVANIA. When you write ask for the new Copperweld Telephone Data Book No. 12.

FOR SALE: 120 Western Electric No. 22C Combined Drops and Jacks, five per strip. Good condition. New thimbles, refinished mounting plates. $4.00 per strip. Also Paragon Battery boxes @ 25c. Manawa Telephone Co., Manawa, Wis.

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